ELECTRICAL REVIEW

FRIDAY
3 APRIL 1959

WEEKLY
PRICE 1s 6d

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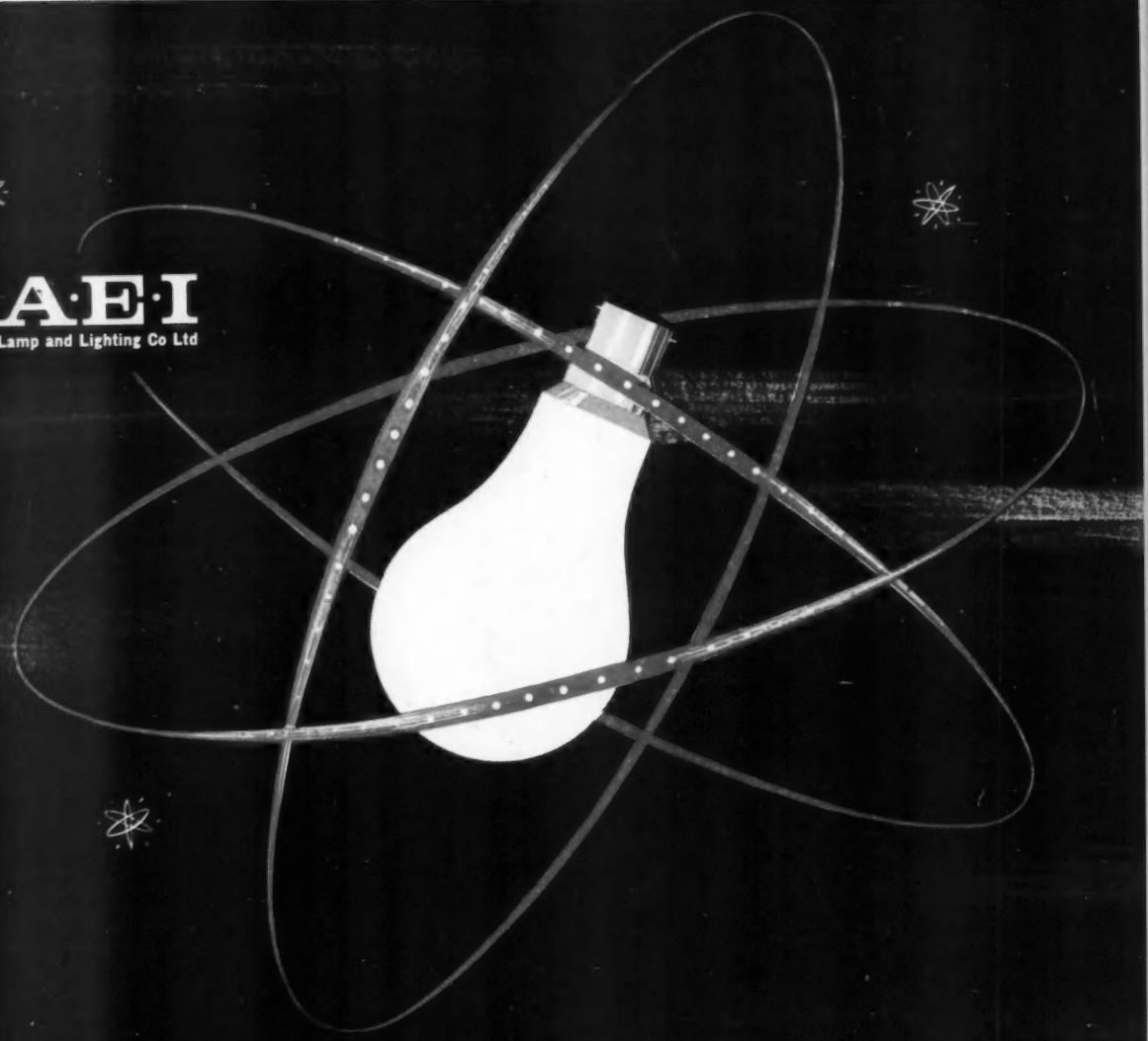
Lamp and Lighting Co Ltd



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Buttercups at Richborough

Two 860,000 lb/hr "Etaflo" water tube boilers are being built by John Thompson for the C.E.G.B.'s Richborough generating station.

The "Buttercups"—yellow helmeted John Thompson erectors—are conspicuous on power station and industrial sites all over the country, and in many territories overseas. They instal water tube boilers, coal and ash handling plant, stokers, water treatment plant, steelwork and pipework, galleries and ladders—all products of companies of the John Thompson Group. John Thompson Water Tube Boilers Ltd., design, manufacture and instal complete steam-raising plant for power generation and industry, and are now in the forefront of those who have extended their existing facilities to Nuclear Power Plant manufacture.

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ELECTRICAL REVIEW

3 April 1959 Vol. 164 No. 14 Established 1872

Nuclear Power Exports

IN the White Paper "A Programme of Nuclear Power," issued early in 1955, the Government set out the prospects of developments in this country during the two following decades. It was then said:—"We must look forward also to the time when a valuable export trade can be built up. The experience gained by British industry in designing and building power stations during the next ten years should lay the foundations for a rapid expansion both at home and overseas." Twenty months later the Calder Hall station was inaugurated by the Queen and hopes of overseas business in nuclear power plant ran high.

As it will be about two years before the first of the "commercial" nuclear power stations here will begin to operate it may be considered too early for a re-assessment of prospects. It is likely that many possible overseas buyers will hold off until experience has been gained of large-scale generation by the graphite-moderated gas-cooled type of plant, both from the technical and economic aspects. Nevertheless a British group has already won an Italian contract while another is about to secure an order from Japan.

The industrial companies concerned in this business have not only expended enormous sums in preparing designs and setting up construction establishments themselves, they are also expected to help the United Kingdom Atomic Energy Authority to recover some of its colossal outlay upon research and development. If the whole weight of this expenditure is placed upon the home nuclear power stations the effect upon the cost of the energy produced may be serious. Therefore an export market is essential for the spreading of the preliminary costs, unless they are met in part by the Treasury: in other words if the commercial exploitation of nuclear power is subsidised.

P.E.P. (Political and Economic Planning) has just issued a survey of prospects for nuclear power (reviewed in this issue) in which the needs of many countries for atomic power, and their ability to pay for it, are considered. Points which are stressed are that at present a market exists only for large (100 MW or more) reactors which have been tried and are known to be more or less competitive with coal, and that the purchasing

countries would expect to carry out much of the civil engineering and conventional steam plant work themselves, thus depriving the exporters of nuclear plant of much potential profit. Small reactors, expensive in operation, are regarded as a future development.

At present the United Kingdom and the United States are the only countries who can provide reactors and the necessary fuel service and the United Kingdom has the immediate advantage of extended operational experience. But improved, if more costly, designs are being built and experimented with by the United States constructors more intensively than in this country. This may place the United States in a stronger position in the future. Full advantage has to be taken of our present favourable position if we are to secure a footing in overseas countries and this means the quoting of acceptable prices. Ability to compete abroad may depend on greater collaboration at home. The British nuclear power consortia may find it desirable to pool a great deal of their knowledge and experience in order to cut their costs.

MOUNTAIN AND MOUSE

Just over a year ago the Minister of Power and the Secretary of State for Scotland appointed a committee under the chairmanship of Sir Cecil Weir to consider ways in which the Gas and Electricity Boards could co-operate in services which were common to both industries. After holding sixteen meetings and considering evidence and representations from over a hundred organisations, as well as 150 letters, the Committee has made its report. This clearly shows that what seems to be most desirable is often impracticable. Thus the Committee has had to erect a number of Aunt Sallies provided by other people and then proceed to knock them over—or at least halfway over. It may be said, however, that it has produced an interesting study of the commercial operations of the Boards in so far as they have immediate impact upon the public.

In its conclusions the Committee finds no case for gas-electricity co-operation in meter reading and the running of service centres, except perhaps in remote and scattered areas. It does suggest that there might be a better exchange of information between Gas and Electricity Boards in the planning of street works. For the rest the Committee recommends the Boards to improve their (separate) meter-reading and billing arrangements and their information services. It also considers that "there is scope for improving and extending the informal working arrangements between the Boards of the two industries." Although the Committee did not get very far it has been able to clear the air of a number of erratic notions.

ELECTRONIC COMPONENTS EXHIBITION

One of the most interesting and well attended exhibitions of the year will be taking place at Grosvenor House and Park Lane House, London, next week (6th to 9th April). We refer, of course, to the 16th in the uninterrupted series of annual exhibitions organised by the Radio and Electronic Component Manufacturers' Federation. From details we have already received regarding the exhibition and the equipment which will be on view, this year's show will undoubtedly be the largest and most comprehensive yet staged in this country; altogether some 179 firms and organisations will be represented. This expansion is to be expected in an industry which has quadrupled its output during the past ten years and in which new developments are constantly taking place and new products appearing almost daily.

WARMING EXISTING FLOORS

The installation of electric floor warming in existing premises has hitherto not been considered practicable because of the necessity either to reconstruct the floors or to lay an additional screed. The disadvantages of reconstructing the floors are chiefly the cost and the great time involved, with consequent considerable curtailment of the use of the premises. If an additional screed is laid the disadvantages are again chiefly capital cost but the raising of the floor level even by as little as 2in may be an insurmountable difficulty. Considerable interest, therefore, is attached to the method of installing floor warming cables in concrete floors which has recently been tried out by the South Eastern Electricity Board in a large Nissen hut at Orpington, Kent, and is described in this issue.

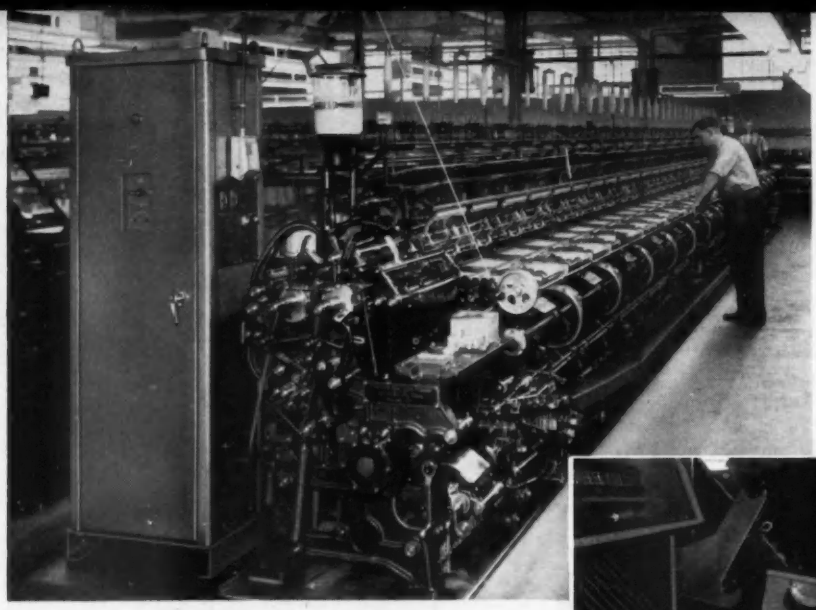
Essentially, the method is to cut a system of slots in the concrete floor using a power driven water-cooled saw. The cable can then easily be fitted into the slot and filled in without raising the floor level. Although the cost of the trial installation was higher, it has been calculated that an installation providing 18·75 kW of heating can be put in for about £190, or £10 per kW. This takes into consideration the hire of the machine, labour and saw, the electricity used by the 15 h.p. saw, water, switchgear, cable and the filling in of the slots.

TELEPHONE PROGRESS

Last year the Post Office managed to reduce its waiting list for telephones by 38,025, but at the end of the year there were still 146,339 unsatisfied applicants. It is the aim to meet all applications for telephone service as soon as they are received but as the amount to be spent on the provision of new exchanges and lines in 1959-60 is less than in 1958-59 it seems doubtful whether progress will be accelerated. On this point the unions representing staffs engaged on Post Office engineering work, in a letter to Members of Parliament last week, claimed that investment was being arbitrarily restricted to a level below that justified by public demand. They contended that this situation was unsatisfactory to the public, the national interest, and the staff employed in the telephone service.

It must be said, however, that since 1955 the Post Office has been able to keep the number of new connections ahead of the incoming demands and thus reduce the number of outstanding applications at a steady rate. In the past three years or so the number of unsatisfied requests for service has fallen from over 375,000 to about 150,000.

Details of the capital expenditure for 1959-60 were given in last week's issue. Subscriber trunk dialling is to be extended to eleven new or enlarged exchanges and a new cable ship is to be ordered.



A 6½ h.p. motor driven hosiery knitting frame with "Emotrol" control giving a ten-to-one speed range; the 30 minute knitting cycle necessitates up to 250 rapid changes in speed

Photo-electric control unit mounted on a wool-carding machine

APPLICATIONS TO BATCH PROCESSES

By W. E. SWALE, M.I.E.E., A.M.I.C.E.

Electronics in the Textile Industries

The author indicates some of the applications of electronics to automatic process control. These are included in the following processes: colour matching, bale breaking, fire detection, wool carding, moisture-content recording, fabric drying, warp sizing, spinning and weaving, and so on

THE term "electronics"—of recent coinage and still often misused—refers to a branch of electrical engineering which deals with the conduction of electricity in a vacuum, in gases and in semi-conductor materials. Its characteristic equipment includes gas discharge lamps and neon tubes, photocells, transistors, transducers (those ingenious devices by which tiny mechanical movements are converted into minute electrical currents) and nucleonic, i.e. radioactive materials, with their associated radiation detectors. Electronic devices operate with unequalled sensitivity and speed; they have therefore become indispensable factors in developing the forms of automatic control which are revolutionising production methods.

The textile industries, like many aspects of engineering, represent batch processes. There is still a large amount of intermediate handling by operatives. Although the nature of these processes has not, in general, lent itself to radical changes by electronic methods, the textile industries do offer some interesting examples of electronic applications and automatic process control.

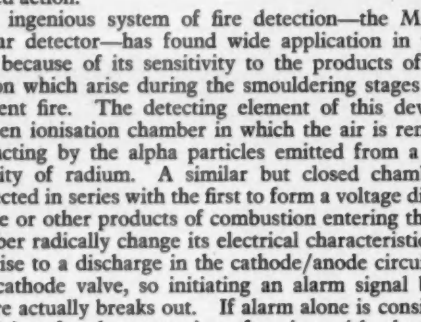
Among the many varieties of fluorescent tube lamps available the one bearing the name "colour matching lamp" is used where a cheap and simple type of colour corrected light is required. The close matching of colours in dyeing and printing calls for a much more critical blend of light sources, such as is found in the new G.E.C. colour matching cabinet. This contains four 2ft light-blue fluorescent tubes, two special ultra-violet tubes of similar size and three 100/150 W incandescent filament lamps. The three different light sources are separately switched and the filament lamps have rheostatic control to compensate for voltage fluctuations. The ultra-violet light component caters for the matching of materials containing dyes which respond to the u-v region of the spectrum and therefore show a colour effect in natural light which is unobtainable under most forms of artificial lighting. The setting of the unit to a known colour basis can be carried out by reference to a dichroic ladder or any other standardising samples favoured by the industry concerned. The total load of the cabinet is 580 W and the illumination provided on the inspection table is 170-200 lumens per sq ft.

Specially designed Hanovia fluorescent lamps, fitted with Wood's glass filters, find many applications in textile processing. These range from the classing and grading of natural and man-made fibres to the detection and identification of mineral and oil stains and the assessment of the efficacy of anti-mildew treatment. The lamps must be used with care as the rays are damaging to the sight.

In the initial stages of bale breaking and opening raw

cotton, pieces of tramp iron, which are easily picked up in the cotton fields or during transit, can cause serious damage and fires in the blowing room machinery. These pieces can be effectively located by a Cintel metal detector. This embodies a search head in the form of a window through which the ribbon of loose cotton fibre passes. A coil system generates an electromagnetic field across the window; this field is normally in a state of balance. If any metal, ferrous or non-ferrous, enters it, the balanced state is disturbed and a signal is fed to an amplifier, where it is magnified and initiates the desired action.

An ingenious system of fire detection—the Minerva nuclear detector—has found wide application in textile mills because of its sensitivity to the products of combustion which arise during the smouldering stages of an incipient fire. The detecting element of this device is an open ionisation chamber in which the air is rendered conducting by the alpha particles emitted from a small quantity of radium. A similar but closed chamber is connected in series with the first to form a voltage divider. Smoke or other products of combustion entering the first chamber radically change its electrical characteristics and give rise to a discharge in the cathode/anode circuit of a cold cathode valve, so initiating an alarm signal before the fire actually breaks out. If alarm alone is considered insufficient for the protection of a given risk, then two-step protection may be afforded by arranging the detector in series with a conventional sprinkler or other automatic fire extinguishing system. In certain conditions, it may



Electrode head of Fielden-Walker evenness recorder

be noted, the surface of an electronic valve will get hot enough in service to ignite cotton "fly."

The use of electronic principles has greatly influenced and improved traditional methods of speed control of electric motors. Typical of many such systems is the B.T.H. "Emotrol" electronic control unit of which the basic components consist of: (a) a d.c. shunt-wound motor; (b) a control panel carrying thyratrons connected as a bi-phase or three-phase rectifier; (c) a transformer for supplying anode power to the rectifier circuits; and (d) a small control panel bearing pushbuttons and a motor speed adjustment knob. The standard speed range is 10 to 1, but ranges up to 100 to 1 can be supplied. The power range covered by this type of control is from ¼ h.p. up to about 600 h.p., the only difference being in the number and size of valves used. These range from single thyratrons to six water-cooled rectifier ignitrons. When fitted with "IR drop" compensation the regulation of this type of control is exceedingly close.

An interesting and promising electronic development is the "Autocount" wool carding control equipment which has been in use commercially for some years. This device is made by the Lancashire Dynamo Electronic Products, Ltd., in collaboration with the users, James C.

High power stroboscope of about 100,000 c.p. at 25 flashes per second; this permits direct reading of speeds from 200 to 6,000 r.p.m. and up to 48,000 r.p.m. by multiplication (E.M.I. Electronics)

Watkinson, Holmfirth, and the Wool Industries Research Association. Its object is to increase the uniformity of the woollen thread by controlling the density of the web passing from the carding machine. The principle depends on the use of a photocell and light source which are mounted over the web after it has left the doffer. The light is reflected back to the cell by means of a mirror placed below the web. The light, which is really the controlling medium, therefore passes twice through the web.

A rotating shutter in the head unit causes the photocell to observe alternately the light source directly and then the reflected light from the mirror. The ratio of these values remains constant as long as the density of the web is unchanged. The density of the web depends, amongst other factors, on the relative speed of the swift and of subsequent parts of the machine. The "Autocount" device provides indication and recording of the weight per unit length of the web. It can also be arranged to give closed-loop automatic control in such a manner as to maintain the web density constant, irrespective of variations in the rate of feed into the carding machine. The device has formed a valuable contribution in improving the carding process and intensive research is still being carried out on these lines.

Moisture Measurement

The recording of moisture in textile goods is important. Cotton yarn is sold on the basis of 8½ per cent regain (in other basic materials and forms of make-up slightly different values may be customary). For various reasons the seller and the buyer should ensure that the accepted values are closely maintained. Two well-known instruments illustrate different approaches to similar problems. The "Shirley" moisture meter (British Cotton Industry Research Association and Record Electrical Co., Ltd.) is based on the fact that the electrical resistivity of a sample of textile fibres depends to a great extent on the amount of moisture which it has absorbed. The instrument consists of a simple mains operated electronic apparatus which has means for setting and checking to allow for changes in valve characteristics and voltage fluctuations. It normally has two hand-held electrodes, one being flat in shape for pressing on to raw cotton or cloth samples; the other is cone shaped for pressing into a cop of yarn. A separate pressure device is available by which a constant test force of 45 lb can be applied. For cotton materials the dials cover a range of from 4·5 to 15 per cent. This meter can readily be adapted for testing most natural fibres, as well as wood pulp and materials in powder form. It cannot normally be used with natural silk, acetate rayon or nylon owing to the high resistivity of these materials.

The "Drimeter" (Fielden Electronics, Ltd.) is intended

for use mainly on any type of fabric drying or warp sizing machine. In these cases it indicates clearly the percentage moisture content of the finished product. The equipment consists of two circular condenser plates which are mounted on a "U" shaped fitting so that the cloth or warp travels between the plates. The capacitance of the condenser is measured by using alternating current of radio frequency. The reading is given on a separately mounted meter. An automatic recorder-controller is available for keeping the machine speed at such a level that the material always has the desired moisture content. This means that the speed of travel of the cloth is reduced when the moisture rises and conversely. If the material is well woven and of constant thickness the control will usually operate within limits of plus or minus 1 per cent.

The stroboscope has many uses in spinning mills and weaving sheds, for example, in checking spindle speeds, in following the paths of fast-moving material such as yarn over guides, and in checking rollers for eccentricity or other mechanical faults.

Control of Variations

There are two devices from which much is expected in the perfection of spinning techniques. Both are based on variations in capacity of a condenser field in proportion to the weight of the cotton passing between the plates. The first is the "Uster" varimeter, in which a condenser field covers the entire width of the scutcher. The associated electronic unit converts these variations of capacity into sound frequency voltage variations. These signals operate an indicator or a recorder. The latter draws a diagram in which variations in weight of the lap-over lengths as short as one inch are clearly discernible. The second is the Fielden-Walker sliver to lap evenness recorder and integrator which is also based on the method of passing the material through a condenser head. Particular care is taken in this instrument to ensure a perfectly parallel electrical field.

The instrument weighs and records one centimetre lengths of material continuously at a speed of five feet per minute. At the same time it integrates the percentage mean deviation over ten-foot lengths. The instrument will cover all materials from the heaviest jute sliver to a single strand of 15 denier nylon filament, but different condenser heads must be used where wide variations are involved. A third instrument in this same class, the "Uster" spectrograph, may be looked upon as an advanced form of the Fielden-Walker device. Amongst other attachments is one which records the number of high or low levels of evenness above the mean. This information may be valuable for quality control. The instrument is expensive (approaching £2,000), but some progressive cotton spinners speak highly of it.

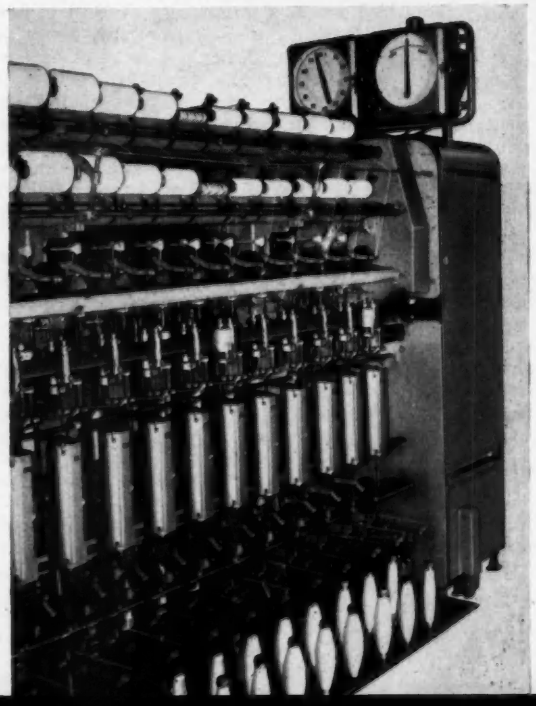
An electronic cotton grader is manufactured, apparently in Hungary, under the trade name "Orion EMG." It is claimed that a cotton maturity index, determining the quality factors of a cotton sample, can be obtained within minutes; that in the case of a known cotton variety both tensile strength and yarn count may be evaluated by reference to this maturity index; that the method of testing excludes subjective errors; and that it does not require special skill in use. The principle of operation is based on the bi-refringence of cotton fibres. A sample of fibres, placed in a beam of linear polarised light, will cause a varying intensity of light to pass, dependent on the cell-wall thickness. A correction is made for the indeterminate number of fibres in each specimen by subsequently viewing the sample in unpolarised light. The intensity of light, measured with the polariser inserted, then depends on the average wall thickness of the fibres only and not on their number. The apparatus weighs only 18 lb and appears, from the description, to be easy to manipulate. If it fulfils its claims it should be very useful to cotton buyers and to spinners, although it would take some time to overcome the experienced cotton man's prejudice in favour of traditional physical and manual methods of grading.

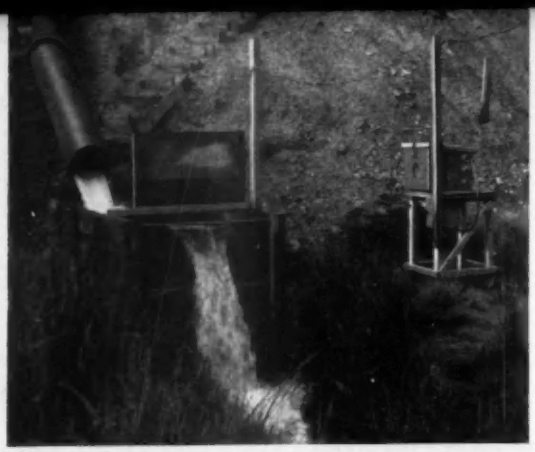
Static Charges

An awkward problem in textile works may be the elimination of the "static" charges which tend to build up, particularly during the manufacture of acetate rayon or nylon. The presence of such charges is well known to the wearers of garments made of these materials. During the processing these charges not only cause the threads to balloon apart, but they also increase the attraction and fixing of objectionable dust particles. The "Shirley" static eliminator made by Record Electrical Co., Ltd., has proved successful when applied to warping and beaming frames. The principle lies in ionising a belt of air through which the yarn passes. Two sets of discharge rods, each fitted with a row of metal points, are supplied from a source of high-voltage d.c. (12,000 V) and produce a continuous output of positive and negative ions. An alternative system has been applied, particularly to looms on which "static-addicted" yarns are woven. This depends on the use of small round boxes which carry charges of a suitable radioactive isotope. These devices are hung in such a way that they produce a field of ionised air around the cloth as it is woven. They are said to be effective, but the life of the capsules may be much less than was estimated and replacement costs are fairly heavy.

An interesting example of the application of electric heat is found in the crimp twisting machine made by Ernest Scragg & Sons, Ltd., and fitted with automatic temperature control by Fielden Electronics, Ltd. The machine is designed for the manufacture of "bulked" yarns. These are made by up-twisting synthetic fibre yarns, of about 2 denier filament, to the extent of about

One end of a crimp twisting frame fitted with electric yarn heaters and an automatic temperature scanner





Effluent control at a works of Laporte Chemicals (W. G. Pye & Co.)

120 turns per inch and heating the yarns to temperatures around 200 deg C in order to fix the crimping effect. The spinners are designed for minimum speeds of 30,000 r.p.m. and great care is taken to ensure uniform tension throughout the process. The numbered metal guards seen in the centre of the photograph protect the totally enclosed 9in long electric heaters which constitute the heat-setting units. A thermocouple is connected to each heater and by means of a motor-driven switch the temperature of each heater is measured every six seconds, the full cycle being completed in 15 minutes. If the temperature of any heater deviates by more than ±1 deg C the scanner stops with the indicator needle at the appropriate heater position and gives a visual alarm. No yarn can be processed except in accordance with specified conditions. This combination of mechanical up-twisting and automatic electric heat treatment has proved highly successful. The latest model, type CS3, has 240 spindles, mounted in pairs, each pair fed from a newly-designed twin-heater unit.

Textile laboratory devices also follow the present-day trends. A vibrascope, developed by the British Rayon Research Association, is used to determine the mass per unit length (denier) of a textile fibre. The principle depends on clamping an electrically charged sample between a vibrator and a tensioning system and causing it to vibrate at its natural frequency. Transverse movements of the centre of the sample induce a charge in a brass screw which acts as a transducer. The frequency of vibration, which is measured electronically, serves as a means of determining the denier. A range of deniers from 0·4 to 450 can be covered. The same Association has developed the "Manra" yarn filament counter, an instrument in which a sample of yarn is stretched under controlled tension and slowly cut. A stylus like a gramophone pick-up senses and records a signal every time a filament is severed. The desired data are obtained accurately and far more quickly than can be done by counting under a microscope.

The "Ferranti-Shirley" cone plate viscometer consists of a stationary flat plate and a slightly conical rotating disc, driven by a variable-speed motor at controlled speeds ranging from 1 to 1,000 r.p.m. The viscous traction on the cone exerts a torque on a precision electromechanical dynamometer and an electronic measuring system gives clear readings on a scale having an effective length of 25 inches. The instrument, which can be supplied with three different sizes of cones, gives readings in rate of shear (sec^{-1}) or shear stress ($dyne/cm^2$) and is applicable to a wide range of liquids in common industrial use.

The "Shirley" photo-electric stapler is an ingenious device which replaces the tedious and not very reliable method of "pulling" a fringe or thin layer of fibres from the bulk, arranging them in order of length and then estimating the average length of staple. The operator prepares a "fringe" (made up from 16 small pinches of cotton) and lays this on a pad, covered with black velvet. This is then gradually pushed through the instrument. The essential features of the stapler are the box which houses two photocells and lamps, connected in opposition to one another and a separate galvanometer. The fringe is brought into a position where two strips of light fall across the sample. The opposed cells pass a current which is proportional to the difference in intensity of the two illuminated strips of fibres and is therefore substantially proportional to the fibre density gradient mid-way between the strips. The distance moved between the two positions of maximum density gradient, which are indicated on the galvanometer, is termed the P.E. staple. The instrument is said to be simple to use, but the success of the method depends essentially on preparing the fringes according to a precisely fixed technique. The preparation and test of an individual fringe takes between two and three minutes.

In any process which involves the interaction of textile fibres with chemical solutions such as are used in scouring, bleaching and dyeing yarns and cloth, one criterion of efficiency can be said to be a function of the pH value of the bath. This should therefore be continuously metered. The same applies during the treatment of boiler feed water and of trade effluents. The pH scale, in practice, ranges from 2—strongly acid, through 7—neutral, to 14—strongly alkaline. Smaller works will be served by a portable or bench type meter which allows routine tests to be made of samples taken on site. Many larger works have installed permanent automatic equipment for continuous process control. The principle of pH measurement depends on measuring the voltage across two specially prepared electrodes immersed in the liquid. The sensitivity of these industrial pH amplifiers is high (about 100 μA/pH unit) so that recorders, indicators, control and alarm systems can all be operated from the same amplifier.

Photo-Electric Slub Detector

Slub catching, that is detecting and arresting knots and blemishes in spun yarn, has been a perpetual problem in the spinning industry. Mechanical slub catchers are effective up to a point, but do not achieve all that is desired. A photo-electric slub detector is comparatively simple to devise but is expensive when applied to every spindle on a 400 spindle frame. In this connection a recent development is likely to be of considerable interest. The apparatus is an automatic warp inspector, designed and manufactured by Bruce Peebles & Co., Ltd., in close collaboration with the British Nylon Spinners, Ltd. It is claimed that the device is fully automatic, reasonable in price, extremely reliable and that it will detect any faults, for example, breaks, neps, fly, broken filaments or slubs.

The principle consists in guiding a sheet of threads very accurately in the same plane. This is done by passing them over three ground ceramic guide rods. The sheet is illuminated from one end by a suitable light source which shines on to photocells at the opposite end. The shadow of the warp threads falls on the light-sensitive cells as the shadow of a single thread. This shadow is modified by the passage of any of the above-mentioned faults on any thread. The resulting electrical signals are amplified to operate a fault indication device. With the present design the warp speed is from 30 yd/min upwards and the inspection width is 36in.

Conveyor Control Systems

PROBLEMS IN LARGE INTEGRATED CONVEYOR SCHEMES

After discussing the three basic methods of sequence starting and means of automatic tripping, the author describes some complex systems and shows how these can be simplified and broken down into basic circuits. Safety devices and mimic diagrams are also mentioned

By Thomas P. Thomson, B.Sc., A.M.I.E.E.

THE earliest recorded form of conveyor is probably Archimedes' screw, and references to the use of conveyors have been made as early as the 18th century. It was not, however, until the first quarter of the 20th century that developments in electrical control gear and in conveyors made possible the complicated systems in use today. The invention of electro-magnetically operated switches led, by the 1920's, to remotely controlled contactors. At the same time, the rubber covered belt invented by Robins in 1896 had developed into the familiar troughed belt conveyor, and the tendency to group motor starters in centralised cubicle starter boards together with the flexibility of control so obtained, enabled complete systems to be operated from a single point. Modern practice is to treat the materials handling plant as an integral part of any industrial installation.

Basic Circuits

In the simplest form of conveyor system, the conveyor at the discharge end starts first, followed by the conveyor which feeds it, and so on. There are three basic methods of transmitting starting and stopping impulses between conveyors. These arrangements have been termed power sequence, pilot sequence and sequence starting by centrifugal switch.

Power Sequence.—In this system, the contactor of the first conveyor, when closed, feeds power to its motor and to the contactor of the next conveyor in sequence. This contactor automatically closes, since its coil is connected across the supply, and starts its motor. It also feeds the next contactor in sequence and so on. The method has the advantage of simplicity, because neither control circuits nor auxiliary switches are necessary. The disadvantage is that each contactor must be capable of carrying the full-load current represented by all the conveyors following in sequence.

Pilot Sequence.—This system makes use of auxiliary switches mounted on the contactors. When the first conveyor in sequence is started, an auxiliary switch completes the circuit for the contactor coil of the next conveyor, and so on. In this method, the contactor need only be rated for the current of its associated motor. The auxiliary switches may be time delayed if required, giving a delay between starting of conveyors, and low voltage coil circuits may be used. The disadvantage is the introduction of other components, i.e. auxiliary switches and interlocking connections.

Sequence by Centrifugal Switch.—This system is very similar to pilot sequence except that the contactor auxiliary switch is replaced by a centrifugal switch driven directly from the conveyor belt (Fig. 1). When the conveyor reaches a given speed, the centrifugal switch contacts close and start up the next conveyor in the sequence. The method can be easily adapted to give belt slip protection, as shown later. In addition, a belt cannot start until the belt it is to feed is actually running, as distinct from the preceding contactor being closed. A time delay in starting is inherent.

The main disadvantage of this method is probably price, as a centrifugal switch is obviously more expensive than a simple contactor auxiliary. The economics of a scheme will depend on the lengths and layout of the conveyors and pilot cables.

Automatic Tripping

Each of the above basic methods provides sequence starting of a conveyor system, and automatic tripping back to the loading point from a faulty conveyor. In the event of a fault, the healthy part of the system will continue to run and loaded belts will empty, avoiding the possibility of having to start a complete system against load, unless, of course, the first conveyor in sequence is a faulty one. If parallel feeds are used, material flow may be able to continue. Hand reset overload and tripping devices are necessary to avoid the faulty conveyor contactor "chattering," since it is under the control of the preceding conveyor. An operator must therefore visit the starter before re-starting.

There are many applications in which it is essential that a fault on any conveyor should shut down the whole system and this can be easily arranged by a simple addition to the basic circuits. A contactor auxiliary switch, or centrifugal switch, associated with the last conveyor in sequence is connected in parallel with the initiat-

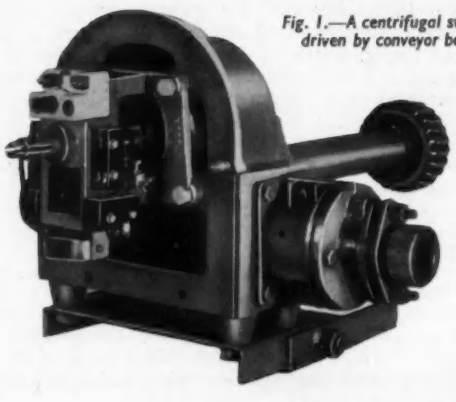


Fig. 1.—A centrifugal switch driven by conveyor belt

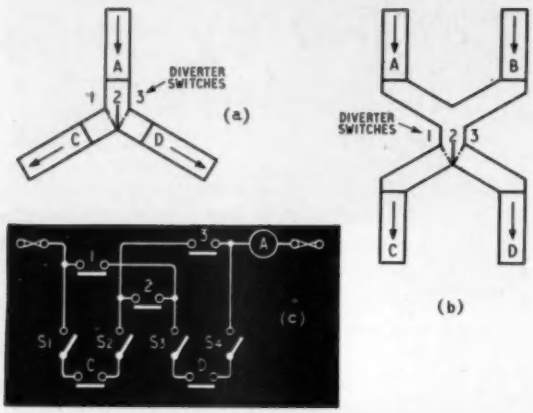


Fig. 2.—Selection circuits

1, 2, 3.—Interlock contacts on the divertor switch. C, D.—Contactor auxiliaries on conveyors C and D. S1–S4.—Contacts on sequence selector switches

ing spring-release start pushbutton in the contactor circuit of the first conveyor in the sequence. The complete sequence must therefore be started before the pushbutton can be released. A fault on any conveyor must shut down the last, breaking the maintaining circuit, and closing down the whole system. If a time delay is employed between starting up conveyors, it is necessary to use a timing relay in the leading contactor to hold the magnet closed while the system starts up. Hand reset trips must be used with this system if there is no time delay between starting of conveyors, otherwise hunting can occur while the start button is pressed.

The foregoing are basic methods from which all systems are built up and it is now proposed to show how circuits are modified and developed to provide the high standard of flexibility and safety demanded by modern practice.

Variations in Basic Circuits

By far the greatest problem presented to the control gear engineer is that of complexity. To illustrate this, consider the simple conveyor systems shown in Fig. 2. In (a) conveyor A can feed either or both of conveyors C and D by means of a three-way divertor switch. There are only three possibilities and the circuit in (c) shows the schematic diagram for the contactor coil for conveyor A. Note that the divertors must be in the correct position for the desired sequence, as proved by limit switch contacts before the preceding conveyor or conveyors can start A.

Consider now the arrangement in (b). Either or both A and B can feed either or both C and D. There are now nine possible sequences. It is apparent, however, that the schematic diagram in (c) still holds for A, and a similar circuit can be drawn for B. Fig. 2 (c) can therefore be regarded as a basic selection circuit which can be used to break down any system into simple elements. The necessary number of selector switch contacts can be assessed and arranged to give the required sequence. Each conveyor which is being fed must have a contactor auxiliary for the maximum number of conveyors which can feed it simultaneously, and each feeding conveyor should be controlled by a divertor limit switch as well as a contactor auxiliary.

Complex Coal Handling Plant

While the basic circuit is relatively uncomplicated, a system built up by using the two arrangements just described can be very complex indeed. Fig. 3 shows a simplified block diagram of a typical coal handling plant for a power station in which coal can be fed from wharves at A by parallel routes to the bunkers at C, or to the stockyard at B. When required, the coal can flow from the stockyard to the bunkers, also by parallel routes. At A, the system is loaded by 12 feeders, up to six of which may feed either or both outgoing conveyors at a time. At B, the coal is discharged from up to three conveyors from four possible unloading points. When the material flow is from B to C, loading may take place on any up to three conveyors from four points. The possible number of sequences for such a system is nearly 86 million and selection circuits and switching arrangements become very complicated. Fortunately, the normal practice of breaking up conveyor systems into functional blocks which can run independently provides a ready solution. In practice, a central hopper is added as shown dotted in Fig. 3, and the system is broken down into four separate and independent systems, viz. wharves to hopper, hopper to bunkers, hopper to stock, stock to hopper. The maximum number of combinations occurs in the wharves to hopper system, but has been reduced to just over six million. This is still a vast number to handle, but again the method of breaking down to functional parts is applied. Conveyors and feeders are treated separately. Since up to six feeders may feed on to one conveyor, six contactor auxiliaries are needed per conveyor. Six 12-position switches per conveyor can be used to connect in the auxiliary and limit switches to the feeder contactor, as indicated in Fig. 2 (c). The required number of sequences can therefore be obtained using 14 rotary switches of manageable size, the other two being for individual control of the conveyors.

Fig. 4 shows a control desk for a coal handling plant similar to that described. The central hopper and the four separate parts of the system can be clearly seen on the mimic diagram.

While the foregoing illustrates complication arising through the sheer number of combinations of simple arrangements, further problems arise when a single piece of equipment needs a complicated control circuit to fit it safely into a sequence, and some examples are given below:—

In a system designed to feed a large number of bunkers, the final conveyor may be of the reversing and/or traverse type. Both of these imply a halt in the material flow when changing the point of discharge. As this may happen several times an hour, means must be provided to keep the system running for, say, ten seconds while the changeover is made. If the changeover is not carried out in the time allowed, the system must be shut down. A distinction must be made between stopping for changeover purposes, and normal and emergency stopping, when a ten second delay is not desirable, and might even be dangerous. It must also be arranged that the operator cannot defeat the

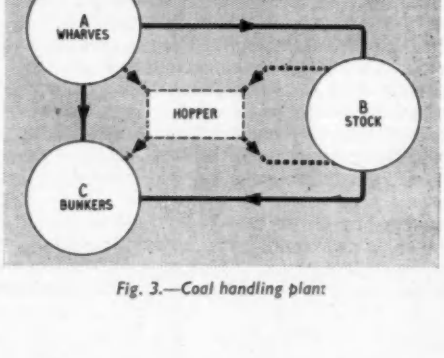


Fig. 3.—Coal handling plant

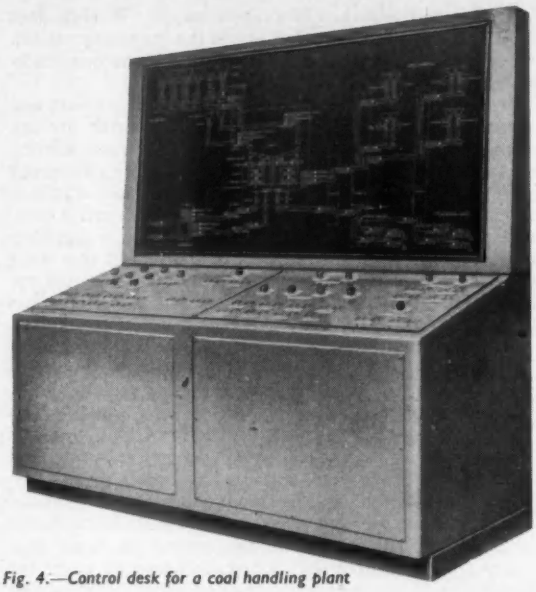


Fig. 4.—Control desk for a coal handling plant

sequence for more than the time allowed by keeping the stop button pressed.

One method is to use three relays including a time delay relay, Fig. 5. One relay is energised by the sequence defeat pushbutton and one of its contacts energises the time delay relay, which maintains itself energised for ten seconds. Another contact on the timed relay is in parallel with the outgoing contactor auxiliary sequence switch, so that the sequence is maintained when the contactor is tripped. The third relay trips the contactor and is energised by a contact on the first relay in series with a contact on the timed relay. The third relay, therefore, cannot energise till the sequence maintaining contact has closed, and it will trip when the sequence defeat pushbutton is released, permitting the re-closing of the contactor. A contactor auxiliary is placed in series with the timing relay coil to ensure that the timer cannot close unless the contactor is closed, though it can maintain itself even with the contactor open. The operator is therefore prevented from starting up the sequence by using the sequence defeat switch.

A specialised requirement has arisen through the development of scoop controlled fluid couplings and their use with cable conveyor belts. The method of control permits the driving motor, or motors, to start up on no-load and to remain running throughout the working period of the conveyor. Stopping and starting are carried out by thrustors inserting or removing scoops which affect the level of fluid in the fluid coupling between motor and conveyor drive. It is necessary to interlock the motor and scoop thrustor contactors so that the motor cannot start with the scoop in the drive position, and that the scoop cannot be operated until the motor is running. In the event of power failure, the scoop must return to the "no-drive" position. If there is more than one drive, the scoops must operate in synchronism. It is therefore necessary to have limit switches at both ends of travel of the scoop. When the belt is part of a sequence, both the incoming and outgoing interlocks are taken to or from the scoop contactors.

A final example of control circuit complication necessitated by specialised requirements is provided by variable speed conveyors or feeders. If such conveyors or feeders are part of a sequence system, the motor starters will normally have to be arranged so that the motors automatically start up at their lowest speed, which means that limit switches must be fitted to field rheostats or commutator brush gear, though this can be avoided in the case of d.c. motors by using accelerating relays. Normally too, it will be desired to vary speed from the central control point, and this will mean running additional cores and pushbuttons from each starter. It may also be desired to have parts of a contributing system shut down when lowering speed, or start up when raising speed. This can be done by using centrifugal switches, voltage sensitive relays, or limit switches at predetermined positions on the shunt field rheostats.

Safety Requirements

The basic circuits described earlier are subjected to still further development due to safety requirements. The most obvious device is to have the control circuits operating on a low voltage, using either a group transformer for the whole scheme, or a separate transformer for every starter. It is considered good practice to earth one end of the transformer winding and connect the contactor and relay coils directly to the earth link. All switch contacts and outgoing cable cores are thereby on the supply side between the relays and the control circuit supply fuse. An earth fault will therefore blow the fuse and shut down the conveyor since the fault current will not be limited by the impedance of the relay coil. Centre point earthing has the advantage of halving the shock voltage,

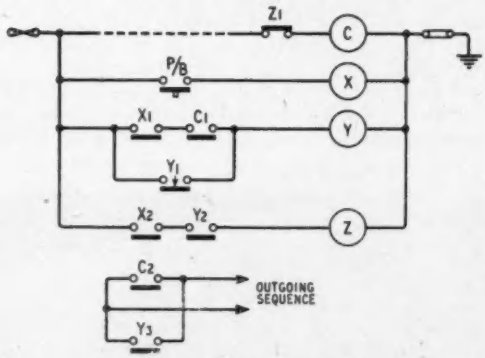


Fig. 5.—Sequence defeat control schematic diagram

P/B.—Sequence defeat pushbutton. C.—Contactor coil. X, Z.—Auxiliary relays. Y.—Time delay relay

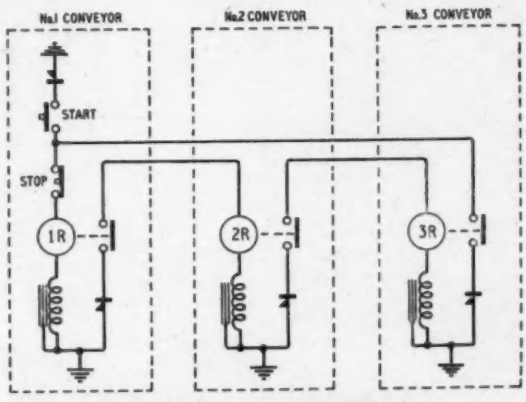


Fig. 6.—A safety scheme using slugged relays

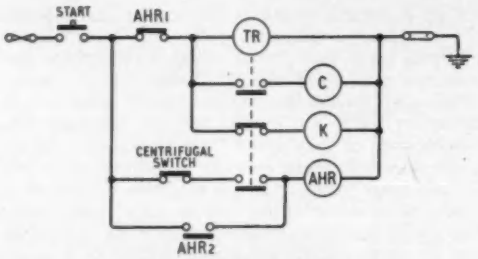


Fig. 7.—Control circuit schematic

TR.—Timing relay. C.—Conveyor contactor coil. K.—Klaxon. AHR.—Anti-hunting relay

but against this, a restricted earth fault might blow only one fuse, and permit the passage of sufficient current possibly to operate a relay and start up a conveyor.

It is usual to fit each starter with a selector switch giving a choice of sequence control or local control. Normally the local position will be used only for test purposes, or emergency running, but it is desirable to have the local and remote stops in circuit all the time, if possible. Pull wire stops, as well as the pushbutton type, may be used. The former gives emergency stop protection along the full length of a conveyor, and may be combined with a signalling system, both audible and visual.

Each industry has its own particular problems and dangers which must be guarded against. One of the most common is belt slip, which can lead to fires through overheating between belt and drum. As mentioned earlier, centrifugal switches may be used to provide belt slip protection as well as sequence stopping and starting. In Fig. 7, when the conveyor circuit is energised, a time-delayed relay closes, after a set period, during which klaxon K is sounded, and then energises the conveyor contactor. The anti-hunting relay is also energised after a timed period unless the centrifugal switch has opened first indicating that the belt is up to speed. If AHR does close, it maintains itself and opens the contactor circuit. An advantage of this circuit is that it resets automatically when the sequence is shut down.

Fig. 8.—Starter board for coal handling conveyors

A safety problem of particular significance in mines and quarries where centralised motor starter boards are not often possible, concerns the danger of inadvertent starting of conveyors due to damage to interconnecting cables. A short between cores is indistinguishable from a closed switch, and as earth continuity control circuits are in common use, an earth fault might also start up a conveyor system. The problem is aggravated by the fact that some at least of the conveyors in a mine are portable and the cables are exposed to very rough usage. A solution has been found in the use of slugged relays, which are insensitive to a.c. circuits, but which react to the d.c. component available from a half-wave rectifier. It can be seen from Fig. 6 that if a short occurs in any interconnecting cable, both the associated relays are exposed to a.c. and will therefore trip. Furthermore, an earth fault on any core will short-out the rectifier, exposing the relay to a.c. and tripping it. In addition to giving this protection, known as pilot fault protection, this circuit can be used to provide earth continuity protection, as the relay circuit is completed through the earthing core of the equipment being controlled. The relay, in this case, must therefore be on the supply side of the outgoing cores, the voltage being about 7·5 from a step down transformer.

Mimic Diagrams

The presentation of information to the operator is another problem to be considered. The desired intelligence may be presented by indicating lamps or by a mimic diagram. In any case, the operator has to know if his selected sequence is running correctly, or more important, at what point it has stopped. An auxiliary switch on the conveyor contactor can be made to light an indicating lamp when the contactor is closed. With normal pilot sequence control, this provides fault indication, since the healthy conveyors will show their lamps, up to the faulty conveyor, after which all the lamps will be extinguished. If the sequence is of the self-maintaining type, however, all the conveyors will stop, and to provide fault information it is necessary to have each tripping device fitted with additional contacts to light an indicating lamp at the control point.

If many sequences are possible, it is helpful if the selected sequence is illuminated at selection, before the start button is operated. This can be done by having a normally closed auxiliary switch on each contactor in series with the sequence selector switch. In Fig. 4, four or five indicating lamps per starter are fitted. In addition to the three given above, an indication is given if the control selector switch on each starter is turned from the sequence position.

A starter board is shown in Fig. 8 which is typical of modern practice and illustrates some points discussed above. The control circuit is a low voltage one operated from a group transformer with one pole earthed. A selector switch gives the choice of desk control (sequence), motor control (remote) or local control (test). Selected/running indication is fed to a control desk, also overload indication, and " selected out of sequence." Belt slip protection is provided and the timing device is also used to energise a warning signal when the conveyor is about to start.

The foregoing has shown how a few basic circuits are applied to conveyor systems to bring them completely under the control of non-skilled operators, but it should be emphasised that each system presents its own peculiar difficulties and challenge to the control gear engineer.

GAS-ELECTRIC CO-OPERATION

WEIR COMMITTEE'S FINDINGS

The Weir Committee set up to study the possibility of co-operation between Gas and Electricity Boards in the administration of services of a like kind reports against joint meter reading and billing and the sharing of showrooms. Limited co-operation between the two industries in certain other directions is thought to be possible

IN March last year the Minister of Power and the Secretary of State for Scotland appointed a committee "to consider ways in which, by co-operation between the Area and Scottish Electricity and Gas Boards in the performance of their respective statutory functions, the administration of services of a like kind provided to the public by the two industries might be improved: and to make recommendations." The chairman was Sir Cecil Weir and the members were Mr. R. R. B. Brown, Mr. G. le B. Diamond, Sir Edward Herbert, Sir John Imrie, Sir Henry Jones, Mr. C. T. Melling and Mr. Austin Morley; later Lady Carew Pole was appointed to the Committee.

Last week the Committee's report was published (H.M. Stationery Office, price 2s). It is made clear at the outset that the Committee was not concerned with the general policy of the Gas and Electricity Boards or with competition between them as it had been told that the Government was in favour of such competition. Therefore the Committee kept before it "the importance of avoiding any change which could weaken the competitive spirit of the industries unless it could be shown to have strong compensating advantages." Written memoranda were received from over a hundred organisations, as well as 150 letters, mainly about bills and visits from meter readers. The Committee was told by the Boards, staff associations and trade unions how unsettling it was to those engaged in the industries to have repeated reorganisations by statute and investigations by committees of inquiry, such as this Committee.

Service Centres

A chapter of the report is devoted to an explanation of the organisation of the two industries. In the course of this it is mentioned that while in the electricity industry only about a fifth of the consumers have slot (prepayment) meters, in the gas industry the proportion is about two-thirds. In England and Wales about two-thirds and in Scotland about half of all "credit" accounts are paid by consumers at service centres. At their service centres Gas Boards sell most of their appliances. The Electricity Boards also sell appliances at their centres but this accounts for only from one-seventh to one-eighth of the total sold (the rest being bought from private concerns), excluding radio and television apparatus of which the Boards sell only about 1 per cent. Mention is made of the criticism arising from the operation of separate service centres by the two industries and of the arguments in favour of this practice, but as the sale of appliances is a statutory function of the Boards the Committee considered the subject "only to the extent that co-operation between the Boards in their arrangements for appliance selling might improve the service provided to the public."

The Committee next considers the arguments for and against joint meter reading, from the aspect of convenience to the consumer. Although a number of witnesses and organisations made it appear that it would be better to have one man reading gas and electricity meters the Committee does not believe that administratively joint meter reading would ever be as satisfactory or efficient as separate meter reading. It is thought that the suggestion of inconvenience to the householder is exaggerated.

Meter Reading

Whether it is more efficient to have joint meter reading is then studied. While the idea seems attractive, the Committee says that it had abundant evidence to prove that under conditions of competitive enterprise the difficulties are considerable. The complications involved are stated and it is said that one obstacle is the high proportion of slot meters. Experience of joint meter reading in France and the United States is different as where it is practised in these countries the two services are under the same or closely-linked organisations. Studies made in 1954 for the British Electricity Authority and the Gas Council (given in an appendix) showed that for the country as a whole the savings would not be large enough to justify acceptance of the difficulties which would result from reorganisation and administrative changes. After studying this report and other evidence the Committee reaches similar conclusions and in view of this it thinks that the organisation of billing should be left to the individual Boards.

The Committee goes on to specify the methods of meter reading and accounting by the Boards and improvements which have been instituted. It recommends the continuance of flexibility of ideas and experimentation, but thinks that the Boards should arrange for full interchange of information about what they are doing.

Both Gas and Electricity Boards said that Government policy of encouraging competition between the industries made it necessary for them to maintain a qualified and enthusiastic sales staff who were convinced of the merits of what they had to sell. They felt that this could not be done if showrooms were shared by competing industries and consequently the interests of the consumer would suffer. There may be some scope for sharing premises in outlying places, where business is insufficient to justify two separate establishments, but even there a better service may be provided by means of the increased use of mobile showrooms. The Committee does not recommend the sharing of showrooms as a general policy.

Some witnesses represented to the Committee that all advertising by the Boards was unnecessary and a waste of money but with this the Committee does not agree. The competing industries must use the same methods as commercial firms. In fact the advertising expenditure

is said to be modest in comparison with that of certain other industries; it amounts to about one-third of one per cent on total turnover. Moreover, the Boards have also to compete directly with oil and coal and indirectly with other claimants for a share of the consumers' spending power. It is felt, however, that excessive competition between the two industries in advertising could be avoided by discussion between the chairmen and senior officers.

The Committee accepts the case for expenditure on displays at exhibitions and agricultural shows (which had been criticised) and it also seems to the Committee that the Women's Gas Federation and the Electrical Association for Women, which had been said to be "unreasonably and unfairly subsidised" by the respective industries, do very useful work.

On the subject of the digging up of streets it is considered that all the undertakings concerned should meet regularly to discuss future plans for road works. The highway authorities are the natural bodies to convene and conduct such meetings.

Among other subjects mentioned by witnesses as providing possibilities of co-operation were combined gas-electric appliances—this, the Committee thinks, can be left to the manufacturers concerned; joint motor vehicle repair depots—thought to be a matter for settlement according to local circumstances; uniform account forms—variety may be inescapable; and the reference of some subjects to joint meetings of Gas and Electricity Consultative Councils in the same area—the Committee thinks that there is nothing at present to stop this. Two suggestions outside the Committee's terms of reference were that only one service (which would have to be electricity) should be provided on new housing estates and that the Committee should examine the working of Consultative Councils.

The Committee's detailed conclusions are that:—

(1) Boards should be free to organise their own meter reading and billing arrangements in the way they consider most efficient and economic and most convenient for their consumers.

(2) It does not recommend joint meter reading, but accepts the possibility of local joint arrangements in remote and scattered areas.

(3) Boards should consider offering the alternative of estimated readings of credit meters, with one or two balancing readings a year, to credit-worthy consumers.

(4) Boards should continue to experiment with various meter reading and billing arrangements (using work study in the task of meter reading and collection) and consider improving arrangements for exchanging information on procedures.

(5) There is no general case for the sharing of service centres, although this might be considered in some thinly-populated country districts.

(6) Boards should consider the wider use of mobile showrooms in some rural areas rather than the provision of permanent buildings.

(7) Boards should remain free to spend reasonable sums on advertising, in order to be able to develop balanced sales of gas and electricity.

(8) Consumers, Consultative Councils, the Press and other responsible bodies should be kept informed of developments in all fields affecting consumers.

(9) Information should be exchanged as far in advance as possible about plans involving street works, and wherever possible the public should be told of the nature and duration of major street works.

PROPERTIES OF SUPERHEATED STEAM

IN a paper which was presented at a meeting of the Institution of Mechanical Engineers in London on 6th March by Prof. J. H. Horlock (University of Liverpool) approximate equations for the properties of superheated steam are set out.

For superheated steam, over a range of pressures from 200 to 2,000 p.s.i. abs. and a range of temperatures from 400 to 1,000 deg F, it is found that the specific heat at constant pressure c_p and $R_a = p.v./T$ are very closely functions of entropy only. Using this empirical fact it is possible:—(1) To derive a pressure temperature relationship (p/T^{α}=constant) along an isentropic. (2) To show that the index α is a constant, independent of entropy. (3) To obtain an equation of state, by assuming a linear relationship between c_p and R_a. (4) To obtain an expression for the enthalpy. (5) To derive a pressure temperature relationship along a polytropic expansion line (p/T^{δ} = constant, where δ is a function of entropy). (6) To obtain the explicit functions $c_p = f(S)$, $R_a = g(S)$.

Steam thus behaves as a perfect gas in any isentropic process within the specified range of pressure and temperature, but the values of the gas constant and the specific heats vary with the entropy of the specified isentropic process. Superheated steam may therefore be described as an "isentropically perfect gas."

The equations derived are basically similar to equations for steam derived by Callendar, who started from different assumptions. With choice of suitable constants, the equations may be used to estimate the enthalpy to approximately ± 2 B.Th.U/lb and the volume to within 1·5 per cent over the range specified above, except close to the saturation line. For lower pressures and temperatures, different constants (those chosen by Callendar) would give similar accuracy in another wide range.

The equations set out by Professor Horlock should be of use to the steam turbine designer in calculations of cycle efficiency and turbine expansion lines, for the assumptions appear to be valid over a wide range of pressures and temperatures likely to be encountered in current and future turbine development.

Electrolytic Capacitors

A NEW publication, B.S. 2134 : Part 1 : 1959, specifies requirements for fixed electrolytic capacitors having aluminium electrodes for use in telecommunication and allied electronic equipment. Part 1 deals with general requirements and tests and Part 2—to be published later—will specify sizes, ratings, etc., of a standard range of electrolytic capacitors. Use of this standard, as with others in the series dealing with components in this type of equipment, requires reference to B.S. 2011, "British Standard climatic and durability tests for components," which describes a range of tests to which components may be subjected in accordance with the requirements of the relevant standards for the individual components.

Copies of B.S. 2134 may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 7s 6d.

VIEWS on the NEWS

By REFLECTOR

WHILE the Weir Committee, which has just reported, has found it impossible to suggest hard and fast rules for co-operation between the gas and electricity supply industries, mutual assistance in a number of practical ways is of long standing. Everybody has seen electrically-lighted gas showrooms and modern gasworks plant relies very largely on electric motors for its operation. Conversely, all who have visited electric lamp works, for instance, know how much production depends on the use of gas flames. There are many individual instances of the use of electricity in the gas industry. The March issue of *Areatopics*, the staff magazine of the North Western Electricity Board, contains a picture of a gas holder at Stalybridge which is said to be one of several in the Board's area equipped with electric heating to prevent the freezing of the water seals. Each represents a load of about 90 kW, though I should imagine the load factor is pretty poor.

* * *

Although the subject is apparently not considered worth mentioning in its journal, *Electron*, the Electrical Trades Union has been involved in correspondence with the Trades Union Congress about the conduct of its internal affairs. As my readers know, there was a stir some time ago about the methods employed in the election of officials and further protests against the non-recognition by the Union of a delegate to the T.U.C. who had resigned from the Communist Party. In response to a request from the General Council of the T.U.C. the E.T.U. has sent two letters of explanation but the Council has rejected these as being unsatisfactory. The T.U.C. is believed to be in an awkward position; it is always reluctant to interfere in the affairs of individual affiliated unions. All the same, it is something that the matter is being aired. If the E.T.U.'s leaders are mishandling some of its affairs, as has been alleged, publicity may cause them to revise their methods.

* * *

Have I mentioned the use of the term "plug top" before? If I do so again it is because it seems to be increasingly employed and I do not much like it. In the "old days" there were plugs and sockets; now there are "plug tops" and "socket outlets." To me a plug top is the cover, i.e. something less than half of the plug. The new nomenclature is another example of the introduction of superfluous words, or the complication of the simple and sufficient.

* * *

Small increases in electricity charges in this country create a great stir, for nobody likes to pay more for anything. In Buenos Aires electricity consumers really have something to complain about; according to the *Monthly Journal* of the British Chamber of Commerce in the Argentine Republic, recent increases in electricity charges will raise the average householder's bill by 50 per cent. Apart from higher basic rates, there are a series of surcharges to cover such items as the redemption of C.A.D.E. and C.E.P. shares, the expenses incurred by these two concerns in respect of fuel and salaries, a "Special Compensatory Fund" and an "Electricity Power Reserve Fund." It is noted that taxes levied by municipal and provincial authorities continue in force. Moreover,

> "it has been pointed out that the new rates are provisional and will be increased later to cover amortisation and interest charges on loans obtained to finance the country's electric power supply expansion."

* * *

There is an entertainer who, without any apparent source of supply or wires, causes electric lamps to light up. I do not suppose he would claim to produce the necessary electricity himself but there is a lady in Gillingham, Kent, who is alleged by the *Yorkshire Evening News* to possess this unusual gift.

> "She discovered her strange power a fortnight ago when she was about to fit an electric light bulb into a socket in her home. Before the bulb was connected it began to glow. Puzzled, Mrs. Kelly tried other bulbs, with the same result."

The newspaper reports that a "spokesman" at the National Physical Laboratory said that almost everyone is capable of charging themselves up by the friction of their clothes on the body. "This generated electricity could perhaps just work on a gasfilled bulb"—a statement which, as Huckleberry Finn remarked, is "interesting, but tough."

* * *

Eighty years ago, when this country was involved in the Zulu War, the *Electrical Review* (1st April, 1879) reported that:—

> "Lord Chelmsford has asked for a field telegraph to be sent out to him; also electric lights for his encampments. The Ordnance Department at Woolwich have accordingly forwarded a fully equipped wire-wagon-and-barrow apparatus to the *Loanda*, now taking in cargo at the Royal Arsenal. The wagon consists of a strong but simple framework on ordinary wheels, supporting on revolving spindles six drums or reels of telegraphic wire, the movement of a lever and clutch causing the vehicle either to lay or pick up the wire as it passes over the ground. The barrow carries a single drum, and is mounted on wheels only 2ft high, with a 2ft track. It resembles an ordinary hose-reel, and is so light that it can be run over the field by one or two men, and can, therefore, be of use during an action. Each drum carries 133 lb of wire. The wagon carries telegraph poles, a ladder and tools for constructing an 'air line.' The poles consist of iron tubes, in lengths of about ten feet, uniting by a bayonet joint and secured by three guy lines. A few sets of electric lighting apparatus and portable engines will also be sent out."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

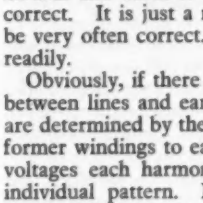
System Harmonics

I WAS very disappointed after reading Mr. A. G. Powell's article on three-phase system harmonics (23rd January issue). Though Mr. Powell's conclusions are generally correct, part of his analysis is basically wrong. As the point in question seems to be one of perennial confusion, I should like to present a short correcting argument.

First, the diagram of Fig. 2 is not applicable because it represents only the case of an inductive single-phase load of fundamental frequency applied between line and neutral of a star/star transformer. As vector diagrams are based on the simple harmonic graph, they can handle only quantities of the same frequency. Third harmonic diagrams are perfectly legitimate, but they cannot be combined with fundamental frequency diagrams. Naturally, an erroneous argument can only yield a wrong conclusion. In fact, the statement (page 150) that the voltage between neutral and earth is $E_3 \sin(3\omega t + \alpha)$ is not generally correct. It is just a matter of chance that it happens to be very often correct. Why this is so can be seen quite readily.

Obviously, if there is no neutral earthing, the voltages between lines and earth, and between neutral and earth, are determined by the capacitances of the lines and transformer windings to earth. In the case of non-sinusoidal voltages each harmonic component will follow its own individual pattern. In a balanced three-phase voltage system of fundamental frequency there is no voltage from the winding star point to earth.

The third harmonic voltage distribution to earth is determined by the following simplified capacitance network:—



The three phases are in parallel connection;
1 is the line side of the windings;
2 is the neutral side of the windings.
If E_3 is the third harmonic e.m.f.

$$U_{20} = -\frac{C_1}{C_1 + C_2} E_3$$

Three limit cases stand out immediately:—

1. $C_1 \gg C_2$; the transformer is connected to a long line.
   $U_{20} = -E_3$
   Thus, the neutral oscillates in anti-phase to E_3.
2. $C_2 \rightarrow \infty$; the neutral is earthed.
   $U_{20} = 0$;
   $U_{10} = E_3$.
3. $C_1 = C_2$; the transformer is idling or connected to a short line.
   $U_{20} = -\frac{1}{2} E_3$.

Naturally, this short note can only touch lightly upon this very interesting question. Its sole purpose is to show that these problems must be tackled by other means than oscillating neutral diagrams.

St. Catharines, Ontario. R. J. KAYSER,
Transformer Engineer,
English Electric Canada
(Division of John Inglis Co., Ltd.).

Mr. Powell comments as follows:—There is no objection to the combination of fundamental and third harmonic diagrams to illustrate their co-relationship so long as the intention is clear.

In the circumstances quoted, the statement of voltage between earth and neutral point was correct. In this connection, I am not sure how Mr. Kayser's differentiation between something being "generally correct" and "very often correct" is to be understood.

Mr. Kayser's further comments are as an extension to the article and deal with the effect on the neutral point voltage of varying conditions of line capacity, etc. His analysis of the limit cases is interesting but this goes beyond the scope of the original article.

Proposed I.E.E. By-Law Changes

AT a special general meeting of the Institution of Electrical Engineers which is to be held in London next Thursday, 9th April, a number of alterations to the by-laws will be considered. The main change proposed is in connection with annual subscriptions and entrance fees. The subscriptions would be increased by varying amounts up to £2 per annum. If the proposals are approved the amounts will be as set out below:—

	In Great Britain, Northern Ireland, the Isle of Man and the Channel Islands.			Abroad.		
	£	s.	d.	£	s.	d.
Members	9	0	0	8	0	0
Associate Members (age 45 years and over)	7	5	0	6	10	0
Associate Members (age under 45 years)	6	15	0	6	0	0
Companions	9	0	0	8	0	0
Associates (age 45 years and over)	7	5	0	6	10	0
Associates (age under 45 years)	6	15	0	6	0	0
Graduates 35 and above	6	0	0	5	0	0
Graduates over 28 and under 35	5	2	6	4	7	6
Graduates 26-28	3	17	6	3	12	6
Graduates under 26	2	17	6	2	15	0
Students 26-28	3	15	0	3	10	0
Students 23-26	2	12	6	2	10	0
Students under 23	1	15	0	1	12	6

In the explanatory notes attached to the schedule of the proposed by-law changes which was recently sent to all members of the Institution, it is stated that these increases were the only alternative to restricting the present range of the Institution's activities or to postponing the much needed building reconstruction which is now in progress at Savoy Place. The Council feels that members would not wish either of these alternatives to be adopted, particularly as postponement of the building work would very likely lead to greater expense in the long run.

Another proposed change is the raising of the minimum age for full membership from 30 to 33 and for Associates from 28 to 30. The requirements for the admission of an Associate Member are now set out in a different form; for instance, the minimum age for admission remains 26 for men who have received further education as electrical engineers, but such candidates must have satisfied the requirements of the new Training Regulations. If a candidate has not been educated as an electrical engineer in this way, he must be at least 28 years old, but again he must satisfy the requirements of the Training Regulations.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. S. F. C. Whitmore,** A.M.I.E.E., to be a full-time member of the South Western Electricity Board. Mr. Whitmore has been manager of the Chilterns Sub-Area of the Eastern Electricity Board since 1952. He took up his new appointment on 1st April.

Mr. S. F. C. Whitmore

Educated at Radley College and Faraday House Electrical Engineering College, Mr. Whitmore served an apprenticeship with C. A. Parsons & Co., Ltd., and in the Electrical Department of the Southern Railway. He then joined the East Anglian Electric Supply Co., Ltd., as an engineer. During the war he served as Army liaison officer with the Royal Navy and was later in charge of R.E.M.E. anti-aircraft workshops in N.W. Europe. When released from the Army he was deputy assistant director of mechanical engineering with the British Liberation Armies in Belgium. On nationalisation of the electricity supply industry in 1948 Mr. Whitmore was appointed manager of the North Essex District of the Eastern Electricity Board, and in 1952 he was promoted to be manager of the Board's Chilterns Sub-Area. He was released from his Board's service for about three months last year to assist in the organisation and direction of a course in business and public administration at the University College of the West Indies in Kingston, Jamaica.

Mr. N. Llewellyn, A.M.I.E.E., hitherto station superintendent, Mexborough power station, has been appointed station superintendent at the Kirkstall and Whitehall Road power stations of the Yorkshire Division of the C.E.G.B. Educated at Canterbury and Rotherham Technical Colleges, he subsequently held positions at Tilmanstone Colliery, Kent, and Nunnery Colliery, Sheffield. He entered the electricity supply industry at Neepsend power station in 1948, and held operational positions at Mexborough, Keadby and Wakefield "B" before being appointed superintendent at Mexborough in 1957.

Mr. F. R. Le Pla, M.Inst.F., M.I.Mar.E., who has been deputy superintendent at Neepsend power station since 1954, has been appointed station superintendent at Mexborough. Mr. Le Pla was educated at Exeter School and after serving an engineering apprenticeship in London he spent three years with the Vickers Boiler Co., Ltd. After experience in the Merchant Navy he entered the electricity supply industry in 1936 with Sheffield Corporation. Before his appointment as deputy station superintendent at Neepsend, Mr. Le Pla was second assistant engineer in the Construction Department, Yorkshire Division.

Mr. D. I. Worthington has been appointed a director of Cable Covers, Ltd. He joined the company in 1950 and was appointed sales manager of its pre-stressed concrete division three years ago. Mr. Worthington, Junr., now shares with his father, Mr. G. D. Worthington, responsibilities connected with the electrical power engineer's equipment and "Talurit" wire rope mechanical splice divisions, in addition to pre-stressed concrete.

Mr. C. A. McLaren has been appointed works manager of Dewhurst & Partner, Ltd., Hounslow. He has been with the company for thirty years.

The East Midlands Electricity Board has established an organisation and methods section at headquarters, and **Mr. J. Billcliff,** A.M.I.E.E., at present district manager at Nuneaton, has been appointed organisation research officer and will be in charge of the new section. He will take up his duties shortly and will be responsible to the deputy chairman of the Board.

Mr. J. Billcliff

The annual ladies' evening of the Midlands Branch of the **Electrical Trades' Commercial Travellers' Association** was held at the Pavilion Suite, Edgbaston County Cricket Ground, Birmingham, on 13th March. Mr. T. C. Browne (chairman) welcomed the guests. The toast to the ladies was proposed by Mr. P. M. King (vice-chairman) and Mrs. Browne responded. At the conclusion of the speeches, a presentation was made to Mrs. Browne by Mrs. King, on behalf of the Association.

Mr. J. W. Kitson has been appointed division manager, Refrigerator Design, of A.E.I.-Hotpoint, Ltd. He was educated at Bablake School, Coventry, and while serving a five years' apprenticeship with the B.T.H. Co., Coventry and Rugby, received his technical education at the Coventry and Birmingham Colleges of Technology. For six years, from 1932, Mr. Kitson was a design draughtsman with B.T.H., after which he went to the Pressed Steel Co. as a design engineer in its Refrigerator Division, remaining there for eight years. He joined the English Electric Co. in 1946 as chief engineer of the Refrigerator Division and six years later was appointed chief engineer, Appliance Division. He became production manager in 1955 and manager of design and development in 1957, the position he held at the time of joining A.E.I.-Hotpoint.

Mr. J. W. Kitson

Mr. D. Hayes, B.Sc.(Eng.), M.Sc. (Econ.), A.M.I.E.E., A.M.C.T., has resigned his position as personal assistant to the deputy chairman of the London Electricity Board and has joined Urwick, Orr & Partners, Ltd., management consultants, as a consultant. Before the nationalisation of the industry, Mr. Hayes was mains engineer with the Ashton-under-Lyne and Leigh (Lancs.) electricity undertakings. From 1948 to 1954 he was transmission construction engineer

Left to right: Mrs. Browne, Mr. T. C. Browne (chairman), Mrs. King and Mr. P. M. King (vice-chairman), at the annual ladies' evening of the E.T.C.T.A. Midlands Branch

with the Merseyside and North Wales Division of the C.E.A., following which he was awarded an electricity supply scholarship to read for a M.Sc.(Econ.) degree in business administration. He became personal assistant to the deputy chairman of the L.E.B. in 1956.

At the annual general meeting of the Electrical Wholesalers' Federation on 19th March **Mr. F. J. Blackwell,** managing director of the Electrical Wholesale Supply Co. (Leicester), Ltd., Leicester, was elected president for the ensuing year. Mr. Blackwell has been a member of the Council since 1956 and chairman of the Federation's Publicity Committee. **Mr. G. Conradi,** of the British Central Electrical Co., Ltd., was elected vice-president. **Mr. J. H. Hirst,** of Hirst, Ibbetson & Taylor, Ltd., was re-elected councillor of the North-Western Section, and **Mr. F. J. Blackwell** was also re-elected councillor of the Midland Section. Mr. Conradi, who has previously served for three years as a general councillor, was elected councillor of the London and Western Section. **Mr. J. W. E. Rutherford,** of Adamson & Co. (Tyne), Ltd., was re-elected general councillor.

Mr. F. J. Blackwell

Mr. S. Hoggart, transmission engineer, South Western Division, C.E.G.B., retired on 31st March and a presentation was made to him recently by Mr. H. S. Davidson, divisional controller, before a large gathering at divisional headquarters. The gift was a cocktail trolley to which divisional and other colleagues in the industry had contributed.

Mr. Hoggart entered the industry in 1912. Much of his earlier service was with manufacturers, including British Insulated Cables, with whom he was concerned with the construction of the first sections of the grid in Scotland. He joined the C.E.B. in 1930 and became transmission engineer, South Wales Area, in 1944. On the reorganisation of the industry in 1948 Mr. Hoggart was appointed transmission engineer for the South Western Division.

Mr. S. Hoggart (left) receiving a presentation from Mr. H. S. Davidson on his retirement

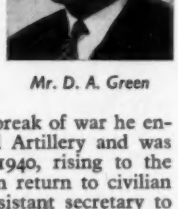
Pending the result of investigations into the possibility of merging the Divisional Transmission and Technical Departments, as a temporary measure **Mr. W. H. Campbell,** M.I.E.E., senior assistant transmission engineer (construction), will assume control of the Transmission Department from 1st April as acting transmission engineer.

Mr. Campbell, following service with the Mersey Power Co., joined Metropolitan-Vickers in 1929, with which company he remained until 1948 occupying various positions and serving during that period on I.E.E. and B.S.I. technical committees. He took up his present appointment in 1948.

Mr. A. W. White, chief engineer of Hoover (Washing Machines), Ltd., Merthyr Tydfil, has just completed twenty-five years' service with his company, and to mark the event Mr. S. Roberts, managing director of Hoover, Ltd., recently presented him with a gold watch.

The annual ball of the **Ipswich and District Electrical Association** will be held on 6th November next at the Royal Hotel, Clacton-on-Sea.

Mr. D. A. Green, A.C.A., F.C.I.S., has been promoted from assistant secretary to be deputy secretary of the South Eastern Electricity Board, a position which has been vacant for the past year. Mr. Green was educated at Highgate School and received his professional training with a London firm of accountants. On the outbreak of war he enlisted in the Royal Artillery and was commissioned in 1940, rising to the rank of major. On return to civilian life, he became assistant secretary to the Electric Supply Corporation, Ltd., and associated companies and when the electricity supply industry was nationalised in 1948 he was appointed secretary to Seeboard's Surrey Sub-Area. He went to the Board's headquarters as assistant secretary in 1954. Mr. Green was chairman of the Sussex Branch of the Chartered Institute of Secretaries in 1956-58.



Mr. D. A. Green

Air Commodore (Ret.) W. C. Cooper, C.B.E., M.A., M.I.E.E., M.Brit.I.R.E., has received the Insignia Award in Technology of the City and Guilds of London Institute for his work on the development of electronic control systems. After distinguished service in the R.A.F. he was appointed, in 1946, factory manager of Ericsson Telephones, Ltd., and in January last year became chairman and managing director of Manlove, Alliott & Co., Ltd., Nottingham, who are engaged in the development of electrical and electronic process control equipment.

Mr. W. G. Picton, a director of International Combustion Products, Ltd., has been elected president of the Mechanical Handling Engineers' Association. He has been with International Combustion Products for thirty-two years, for twenty-two of which he has been manager of the Material Handling Division.

Mr. V. O. Cutts, manager of the Process Heating Department of the General Electric Co., Ltd., retired on 31st March.

Mr. Cutts, a pioneer in the electro - metallurgical field, started in business in Sheffield in 1909. Apart from his work as a consulting engineer, he specialised in electric furnaces and welding. In 1929 he joined the G.E.C. and built up the Process Heating Department covering electric furnaces, high frequency heating (both eddy-current and dielectric heating) and infra-red heating. He has travelled extensively throughout the world and is a Fellow of the Institute of Metallurgists, a member of the Institute of Metals, and other technical bodies, to many of which he has contributed papers and lectures. In 1953 he was president of the Electric Furnace Section of the International Congress on Electro-Heat which was held in Paris.

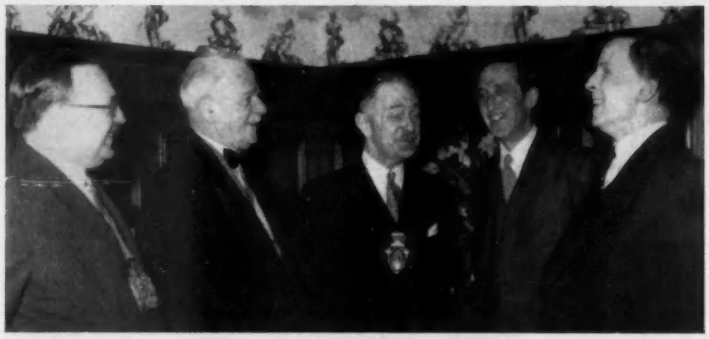
Mr. V. O. Cutts

Mr. Cutts is resuming his consulting practice from his home address at 1, Ramsay Lodge, Hillside Road, St. Albans.

Mr. H. S. Greenough, chief engineer of the Accumulator Division of Siemens Edison Swan, Ltd., since 1951, is relinquishing that position at the end of this month, although for a year he will be available as consultant. From 1st April, **Mr. F. Booth** will become chief engineer. Mr. Booth, who has been deputy chief engineer, was for many years chief chemist in the Oldham organisation.

At the annual general meeting of the British Refrigeration Association on 20th March **Mr. J. A. Howie** (Lightfoot Refrigeration Co., Ltd.) was elected chairman of the Association and **Mr. C. M. Marks** (Hussmann British Refrigeration, Ltd.) was elected vice-chairman.

The annual dinner of the South Wales Branch of the **Association of Mining Electrical and Mechanical Engineers** was held at the Royal Hotel, Cardiff, on 21st March. The function was well attended and among the



At the annual dinner of the South Wales Branch of the A.M.E.M.E. Left to right: Mr. G. H. Bowden (branch president and manager of Johnson & Phillips, Ltd., Cardiff), Ald. A. J. Williams (Lord Mayor of Cardiff), Mr. S. Winstanley (national president), Sir Henry Clay (consulting engineer) and Mr. R. W. C. Reeves (director and general manager, Johnson & Phillips, Ltd.)

principal guests were Ald. A. J. Williams, J.P. (Lord Mayor of Cardiff), Sir Henry Clay, Bt., M.A., M.I.E.E., and Mr. W. A. Gallon, B.Sc., M.I.E.E., M.Inst.F., chairman of the South Wales Electricity Board.

Miss Ellalene Hindle, a sixteen-year-old convent schoolgirl from Torquay, has won the competition organised by the General Electric Co., Ltd., in which competitors had to place in order of merit the most popular features of its "Supreme" cooker. Patrons at cinemas all over the country including those on the Associated British Circuit and customers at Electricity Board showrooms throughout England, Scotland, Wales and Northern Ireland took part. Dora Bryan, Associated British film star, presented Ellalene with her prize of a cooker on the G.E.C. stand at the recent Ideal Home Exhibition.

Mr. E. W. Pond, chief d.c. designer with Laurence, Scott & Electromotors, Ltd., Norwich, has retired after fifty-four years' service. Mr. Pond was apprenticed to the company in 1905 and for many years has been engaged on the electrical design of d.c. machines. He has been closely connected with the development of Scott winches, and in particular with the electrical drive of trawl winches. For some time he was a lecturer at the Norwich Technical Institute.

Mr. E. W. Pond

Mr. G. W. Dunkley, O.B.E., has been appointed a director of the Westinghouse Brake & Signal Co., Ltd.

Mr. R. Cleave, who has been district commercial engineer for East Cornwall of the South Western Electricity Board for the past five years, is leaving Liskeard to take up the position of assistant engineer (sales development) at Redruth. At a farewell party held recently, Mr. F. C. Isaac, district manager of the Board, presented Mr. Cleave and his wife with a barometer.

Mr. T. P. Thomson, author of the article "Conveyor Control Systems" (page 629), received his technical education at the Royal College of Science and Technology, Glasgow, then spent three years as a student engineer with the National Coal Board. After national service with R.E.M.E. as a radar instructor he became a member of the Design and Engineering Department of M. & C. Switchgear, Ltd., working on sequence and interlocking of motor control schemes. He is now electrical engineer with Michael Nairn & Co.

Mr. T. P. Thomson

Sir Vincent de Ferranti is to receive the honorary degree of Doctor of Laws from Manchester University on 13th May.

Dr. J. N. Aldington and **Mr. K. W. Marten** have been appointed to the board of the London Electric Wire Co. & Smiths, Ltd., recently acquired by Associated Electrical Industries, Ltd. Mr. Marten is to be sales director.

Mr. Tamaki Ipponmatsu, vice-president of the Japan Atomic Power Co., was the guest of the United Kingdom Atomic Energy Authority at a luncheon in London on 25th March at which Sir John Cockcroft presided. In the evening he was entertained by Mr. Leslie Gamage, chairman and managing director of the General Electric Co., Ltd., at dinner. At both functions Mr. A. L. G. Lindley, assistant manager of the G.E.C., and Mr. R. N. Millar, a director of the company, were present. Mr. Ipponmatsu's visit to this country was in connection with the contract for the erection by the G.E.C.–Simon-Carves Group of a 150 MW nuclear power plant in Japan and the supply of uranium for running it.

Mr. C. A. Robb, control manager, has been appointed a director of Bakelite, Ltd. **Mr. A. MacKenzie** (U.S.A.) has retired from the board and **Mr. B. T. Burgoyne** (U.S.A.) has been appointed in his place.

Mr. J. H. Sutcliffe Ross, Associate I.E.E., has been appointed sales manager of the Metropolitan Electric Cable & Construction Co., Ltd., in succession to **Mr. T. C. Johnston,** now director and general manager.

Mr. J. H. S. Ross

Mr. Ross, the younger son of the late Mr. W. S. Ross, the first electrical engineer to the Borough of Reigate, became a pupil at Callender's Works, Erith, in 1925 and afterwards joined Callender's Construction Co. During the early part of the war he left Callender's to take up a position with Foster Wheeler. After war service Mr. Ross returned in 1947 to B.I.C.C. and after two years with the B.I.C. Construction Co. he became sales engineer (transmission), London regional sales.

Plessey Nucleonics, Ltd., has announced the following appointments as part of its plans for reorganisation and expansion:—**Mr. G. V. Hough,** M.A., previously commercial manager of Plessey Nucleonics, Ltd., now becomes advanced projects manager, and will also take a special interest in the export activities of the company. **Mr. J. S. Crick,** A.M.I.Mech.E., A.F.R.Aero.S., formerly with the British Oxygen Co., Ltd., joins the company as sales manager. **Mr. B. Daniel,** G.I.Mech.E., a sales liaison engineer with Plessey Nucleonics, is joined by **Mr. R. G. Jolliffe,** A.M.I.E.E., from Hayward Tyler, Ltd., and **Mr. A. Trott,** A.Inst.P., from the research laboratories of Associated Electrical Industries, Ltd.

Mr. P. M. Furse

Mr. P. M. Furse, M.A., A.C.A., has been appointed joint managing director of Furse Wholesale, Ltd., Nottingham. Mr. Furse joined the company in 1952 and was appointed a director in 1955.

Mr. J. Lauchlan has been appointed managing director of Craven Brothers (Manchester), Ltd., following the death

(reported in our last issue) of Mr. J. R. Greenwood, chairman and managing director. Mr. Lauchlan became an executive director of the company last year. **Mr. F. W. Green,** who has served the company since 1930, has been appointed to the board as works director, and **Mr. J. R. Greenwood, Junr.,** who is already a director, becomes technical director. **Mr. W. Lord** continues as commercial director.

At the annual general meeting of International Combustion (Holdings), Ltd., on 24th March, **Mr. G. R. T. Taylor** was elected the first president of the company. Mr. Taylor has served the company for over thirty-five years and was chairman until 1957.

OBITUARY

Mr. Herbert Horton Smith, who died on 17th March at the age of seventy-five, was a member of an Evesham family and one of the founders of Abell & Smith's Electrical Co., Ltd. He resigned the managing directorship of the company two years ago, and was chairman at the time of his death.

WILLS

Mr. W. C. Pycroft, deputy chairman of Ferranti, Ltd., who died on 5th November last, left £18,329 gross (£9,259 net).

Mr. H. S. Broom, M.I.Mech.E., founder chairman and joint managing director of Broom & Wade, Ltd., High Wycombe, who died on 12th September last, left £39,835 gross (£36,285 net).

Mr. C. T. Dunn, B.Sc., A.M.I.E.E., district manager for the Midlands Electricity Board, who died on 8th November last, left £20,451 gross (£20,405 net).

Mr. R. C. Maher, assistant managing director and export director of Ward & Goldstone, Ltd., Salford, who died on 28th November last, left £5,261 gross (£3,170 net).

Mr. T. Golding, O.B.E., A.M.I.E.E., director of W. H. Allen, Sons & Co., Ltd., Bedford, who died on 29th October last, left £34,741 gross (£33,960 net).

Mr. E. M. Waite, formerly in charge of the Electrical Department of Lisbon Electric Tramways, Ltd., who died on 22nd July last, left estate in Great Britain valued at £15,045 gross (£14,910 net).

Mr. J. B. Feltham, M.I.E.E., formerly manager of the Long Eaton District of the East Midlands Electricity Board, who died on 1st December last, left £2,503 gross (£1,115 net).

B.E.P.C. Golf Competitions

The golf competitions run for the benefit of the Electrical Industries Benevolent Association at the Power Convention will both be held on Monday, 1st June. The ladies compete for the Lady Citrine Rose Bowl and the gentlemen for the G. P. Dennis Trophy. These competitions are not confined to delegates and any *bona fide* members of the electrical industry are welcome to take part. Such non-delegates should apply for entry forms to the joint hon. secretary, Mr. Frank Farthing, 22, Regent Hill, Brighton (telephone: Brighton 21705).

Works Change-over

Caribonum, Ltd., manufacturers of carbon papers and ink-ribbons, have completed a change-over scheme from d.c. to a.c. throughout their 6-acre factory at Leyton, E.10, which was commenced in 1956. All machine drives were previously d.c. motors supplied from a 50-year-old 500 V 500 A Crompton Parkinson d.c. generator and another C.P. machine, nearly 30 years old and of similar output. The two machines were coupled to two 420 h.p. Belliss & Morcom steam engines. These generators have now been replaced by two 330 kVA, 415 V, 3-phase Crompton Parkinson alternators, and over 300 C.P. a.c. motors are installed. The alternators are coupled to the existing steam engines and connected in parallel with the London Electricity Board supply. A.c. machine drives were fitted during normal maintenance periods so that production was virtually unaffected.

One of two 330 kVA Crompton Parkinson alternators at the works of Caribonum, Ltd.

The motors range from f.h.p. to 25 h.p. in size and, due to the high percentage of dust and chemical fumes in some of the manufacturing areas, many are of the totally enclosed fan-cooled design. Switchgear in the power house consists of ten "Klad" form "A" 415 V units. There are seven 600 A outgoing units, two 600 A alternator control units and one 800 A incoming grid unit. The peak power requirement of the factory is about 350 kVA.

All-Electric School for Dundee

Work has commenced on Kirkton High School, Dundee, which will be the largest school to be built in Scotland since the war and which will be all-electric with an installed load of over 2,000 kW. Designed by Mr. Robert Dron, A.R.I.B.A., F.R.I.A.S., city architect of Dundee, the school will accommodate 1,700 pupils and will cost nearly £500,000. It will include a fully equipped electric kitchen for school meals and an indoor swimming pool. The building contract has been awarded to Truscon, Ltd., whose "picture frame" pre-cast concrete structural system will be used throughout the building, which will include two-, three- and five-storey blocks. Heating of the new school will be by electric floor warming with a total load of 1,244 kW, plus panel heaters; 129 contactors and 158 thermostats are incorporated in the floor warming circuits.

The specification for the electrical installation was drawn up for Dundee Corporation by the Dundee Area of the North of Scotland Hydro-Electric Board. This calls for 1,358 lighting points (839 fluorescent and 519 tungsten) with a total loading of approximately 140 kW. There will be 137 13 A sockets for general purposes, 64 points for motorised units in the technical rooms, 64 l.v. lighting points for these machines, and 61 l.v. bench points in the science rooms. Throughout the school there will be 24 electric clocks, five electrically operated playground bells, 22 period bells, 30 fire alarm hooters, and 26 fire alarm contact points.

In the domestic science rooms there will be 17 cooker control panels for ten 3 kW cookers and seven 6 kW cookers. This section of the school will also be equipped with points for two 3 kW washboilers, two washing machines, four 3 kW drying cupboards, two spin dryers and 43 irons. Electricity for hot water will be supplied at off-peak periods. Hot water for general school purposes will be provided by three 500 gal water heaters, each of 75 kW; and a 75 kW circulator will serve the swimming pool.

The equipment in the school meals service kitchen will comprise a 33 kW range, five 16 kW boiling pans, one 18 kW fish fryer, two 5·5 kW hotcupboards, two 3·5 kW hotcupboards, three 9 kW steaming ovens, two 6·4 kW general purpose ovens, four food preparation machines, a refrigerator, three 4 kW rinsing sinks, and a 350 gal 75 kW water heater.

INDUSTRIAL NEWS

Japanese Nuclear Power Contract

It was announced over the week-end that the G.E.C.–Simon-Carves Atomic Energy Group is now certain of securing the contract for the first Japanese nuclear power station. *Reuter* reports from Tokyo that the Japan Atomic Power Co. said on Tuesday this week that it would supply the G.E.C.–Simon-Carves Group with a "letter of intent" within a few days for the import of a Calder Hall type nuclear power generator. The "letter of intent" would tell the group that the company would agree to sign a formal contract after certain points, such as the guarantee of an irradiation level of 3,000 MW-days per tonne of fuel, had been settled. It hoped to sign the formal contract by July.

The reactor, the steam plant and generating sets and certain auxiliary equipment will be supplied by the group, but Japanese manufacturers will provide transformers, switchgear and transmission equipment. Advances are to be made by British finance houses for the purchase of uranium from the United Kingdom Atomic Energy Authority. It is expected that the station will be commissioned in 1963.

F.B.I. Annual Report

The many and wide-ranging activities of the Federation of British Industries during 1958 are reviewed succinctly in the forty-second annual report to be presented to the annual meeting next Wednesday. Recalling some of the more important aspects of the year's work in an introductory survey, the president, Sir Hugh Beaver, mentions the resilience of industry in the face of difficult economic conditions and the breakdown in the Free Trade Area negotiations. The F.B.I.'s surveys of industrial trends, held at four-monthly intervals, have been generally accepted as a useful guide for current thinking. The F.B.I. found themselves largely in agreement with the reports of the Cohen Council on Prices, Productivity and Incomes. The Government's measures to encourage consumer spending were welcomed, but the Federation felt that the decision to increase Government expenditure by £150 million might have been accompanied by some more direct stimulus to the private industrial section of the economy.

Throughout the year the F.B.I., in co-operation with the British Employers' Confederation, played a leading part in discussions with the industrial federations of the "Outer Six." At the same time relations with their industrial opposite numbers within the Common Market were strengthened. A booklet on the much misunderstood subject of Commonwealth Preference was distributed on the Continent.

"Self-Service" Wholesaling

The new Bristol branch of the Sloan Electrical Co. (now the senior division of Edmundsons Electrical Wholesalers, Ltd.) was officially opened by the Lord Mayor of Bristol (Ald. F. G. W. Chamberlain) last week. The premises, at Brunswick Hall, Brunswick Square, Bristol, are more commodious than those previously occupied and will serve as a "self-service" store for electrical goods. The company first experimented with this form of wholesaling at Truro in 1955, and the success of the venture has resulted in the enterprise being repeated.

The single-storey building is more than 100 years old and in its adapted form provides excellent accommodation for the three main stores, showroom, offices, etc. The loading and unloading facilities are exceptionally good. Entrance to the store is via a well-stocked showroom where a wide range of appliances and fittings is displayed. From this, access may be gained to the No. 1 store where staff are available to assist customers or to serve in the conventional manner if so desired. Double-deck trolleys are provided for the convenience of customers, who can wander at will through the various stores.

All three main stores (wiring accessories; domestic appliances; and cables, switches, conduit, etc.) are sub-divided with 7- and 8-tiered storage racks, each clearly labelled, with sufficient space between to enable the trolleys to move freely. Apart from being able to keep up to date by seeing the latest goods on offer, the customer also has the opportunity of comparing the merits of broadly similar products.

In all, the premises cover an area of about 6,000 sq ft, and the complete site extends to 13,000 sq ft, which includes parking space for 20 vehicles.

The new branch will serve an area within a radius of about 60 miles and is under the managership of Mr. R. E. B. Harris, who is also a director of the company. The staff of 27 includes three outside representatives.

Radio Valve Agreements Ended

The British Radio Valve Manufacturers' Association states that its agreements with users and distributors of members' products concerning conditions and terms of supply form the subject of a reference to the Restrictive Practices Court. Because the Association has been advised that the agreements are unlikely to be passed by the Court it has decided to terminate them as from 31st March. The agreements will nevertheless go before the Court on 7th April for a formal declaration.

Industrial Welfare Society Courses

A survey of the need for improved operator training techniques will be presented by Mr. W. D. Seymour, of

General view of the showroom of the new Bristol branch of the Sloan Electrical Co., and (right) a section of the No. 1 store

the Department of Engineering Production, Birmingham University, at a two-day course for works managers organised by the Industrial Welfare Society. The course will be held at the Hotel Rembrandt, Thurloe Place, London, S.W.7, on 29th and 30th April. The fee for the course is £6 6s for delegates from member firms and £7 7s for non-members. The Society has also organised a five-day residential course designed to equip employees to instruct their colleagues in kinetic methods of manual lifting and handling. The course, which is being arranged in association with the Central Council of Physical Recreation, will be held at Victoria Court, Eastbourne, from 20th to 24th April. The inclusive fee for the course is £15 15s for delegates from I.W.S. member organisations and £16 16s for those from non-members.

Electrical Engineers' Exhibition

A record number of visitors attended this year's Electrical Engineers' Exhibition, the total attendance for the five days being 68,249. There were 639 overseas visitors from 71 countries compared with 600 from 60 countries last year. Next year's show will take place from 5th to 9th April and will again be staged at Earls Court.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton	£180 0s 0d
COPPER, H.C. Electro	ton	£246 5s 0d
Fire Refined 99·70%	ton	£245 0s 0d
Fire Refined 99·50%	ton	£244 0s 0d
COPPER Tubes ..	lb	2s 4½d
Sheet	ton	£276 5s 0d
H.C. wire and strip	ton	£298 5s 0d
LEAD, English ..	ton	£67 10s 0d
Foreign	ton	£66 0s 0d
MERCURY	flask	£77 0s 0d
TIN, block (English) ..	ton	£775 10s 0d
ZINC, G.O.B. Foreign	ton	£73 5s 0d
BRASS Tubes (solid drawn)	lb	1s 11½d
Wire	lb	2s 8½d
PHOSPHOR BRONZE Wire	lb	4s 2½d
PLATINUM	oz	£28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb	27½d—27¾d

Radiation Group New Headquarters

Radiation, Ltd., is to build a thirteen-storey office block on the North Circular Road at Neasden, London, N.W.10. The tower will be of reinforced concrete construction and 160ft high. It will provide office and ancillary accommodation for the directors and staff of the parent company, as well as for the secretarial, commercial and publicity departments for the gas, electrical, solid fuel and warm air divisions, and associated companies. Outline town planning approval has been granted and construction is expected to commence this year. A model prepared from the architect's preliminary design is shown in the accompanying picture.

A model of the new headquarters of the Radiation Group which is to be erected on the North Circular Road at Neasden

Radiation Monitoring

A complete radiation monitoring service for users of X-ray equipment and radioactive materials is now offered by the newly formed Radiological Division of the Electronic Machine Co., Ltd. A numbered monitoring film holder and radiation sensitive film, supplied by the company, is worn or carried by the bearer. The film is returned weekly to the monitoring service for processing, reading and recording, a replacement film being provided. In the event of a weekly or accumulative dose exceeding that recommended by the International Commission of Radiological Protection the organisation concerned is immediately informed. A booklet describing the service is available from the company at 41, Lodge Road, West Croydon, Surrey.

British Refrigeration Association

The report for 1958 of this Association takes the form of indicating how the individual objects of the Association were fulfilled during the year. Under the various headings it is shown that the activities included the administration of the Domestic Refrigeration Development Committee; representations against hire-purchase restrictions and the rate of purchase tax; an organised approach to house designers and builders to make them more conscious of domestic refrigeration; the arranging of financial support for the International Dairy Congress; representations in connection with Commonwealth tariff applications; and watching the interests of refrigerator makers in the operation of the European Common Market.

Trading conditions were kept under review and views and information were provided to Government Departments and other organisations concerned with refrigeration in various ways. The Association continued its endeavours to maintain high standards of quality, design and workmanship in the industry, to promote standardisation, to promote and encourage propaganda on behalf of the industry, and to conduct research and provide statistical information.

Winfrith Heath Reactor Project

The agreement for the international construction of an experimental high temperature gas-cooled reactor, to be run by six European countries, together with Euratom, was signed in Paris on 23rd March. The signatories were the chairman of the United Kingdom Atomic Energy Authority, Lord Plowden; the president of Euratom, M. Etienne Hirsch; and representatives of Austria, Denmark, Norway, Sweden and Switzerland.

The new project, known as "Dragon," is the third of the O.E.E.C. European Nuclear Energy Agency's jointly run undertakings to be put into operation. The reactor will be constructed at the Winfrith Heath Research Establishment of the U.K.A.E.A., and is designed for the investigation of the use of high temperature gas-cooled reactors for nuclear power stations and for other applications. The cost of the project is estimated at some £13·6 million, £10 million of which will be shared among the participating countries and Euratom, and the remainder by the United Kingdom.

Materials Data

Materials Data, Ltd., 273, Farnborough Road, Farnborough, Hants., has sent us particulars of the services and publications which it offers. The services consist of the collection, electronic computation and dissemination of up-to-date information on a large number of materials, including steels, alloys, refractories, electrical materials, woods, adhesives, plastics and reinforced plastics. In parts 1 and 2 of its first publication the materials are in sets of tables, in each of which the order of merit denotes the ability of material to perform a specific task. Membership of the Materials Centre (£7 7s per year) entitles subscribers to receive Part 1 (mainly mechanical properties), Part 2 (mainly electrical and thermal properties) and Part 3 (combined mechanical and electrical and thermal properties).

Batti-Wallahs' Society

The Admiralty of the days of Samuel Pepys, who was permanent secretary at the Admiralty, and the conditions of the present day were compared by Sir John Lang, the present permanent secretary, in an informative address at last week's luncheon of the Batti-Wallahs' Society, in the course of which he indicated the complexities of the secretary's task, as compared with the more leisured days of two centuries

ago. Mr. H. H. Spencer (president) presided, and Mr. W. C. M. Couch (a past-president), who is Deputy Director of Electrical Engineering, Admiralty, proposed a vote of thanks to Sir John. Mr. T. C. F. Bigland (the "Mate") announced that the next luncheon would be held on Wednesday, 29th April, when Mr. P. G. H. Fender, the former Surrey cricket captain, would be the speaker.

English Electric Sudan Contract

An agreement has been signed between the Sudan Government and the English Electric Co., Ltd., and Siemens Schuckertwerke A.G. for the construction of a hydro-electric power station at the Sennar Dam on the Blue Nile and an extension to the Khartoum power station, reports Barclays Bank D.C.O. from the Sudan. The total cost of the project is £S4·5 million and it will be executed in two stages, the first to be completed in January, 1961, and the second in April, 1962.

Films for B.A. Meeting

The British Association for the Advancement of Science is to award "Certificates of Participation" for those films selected for screening at its annual meeting at York from 2nd to 9th September. The Scientific Film Committee of the Association is at present considering films recommended for screening (16 mm only), and any sponsors, producers, distributors, or users who still wish to make recommendations are asked to forward these as soon as possible to the Visual Aids Officer, British Association for the Advancement of Science, 18, Adam Street, Adelphi, London, W.C.2.

Bahamas Radio-Telephone Contract

A contract for a high power, forward-scatter radio-telephone terminal for Nassau has been awarded to Standard Telephones & Cables, Ltd. The terminal will be part of a link to connect the Bahamas with the telephone network in the U.S.A. The contract includes the installation of a multi-channel v.h.f. radio-telephone network to connect Nassau with the neighbouring Eleuthera Island, and the total value is nearly £250,000.

Forward-scatter radio-telephone transmitting equipment

Plant for Russia

At a Press conference in London last week Mr. W. L. Mather, a director of Mather & Platt, Ltd., announced that the company had received an order through Rustyfa, Ltd., the consortium which is building a Russian tyre factory, for pumps and electric motors. Mather & Platt is one of the companies in the consortium. Mr. Mather said that his company was hoping to book Russian orders worth £3 million to £4 million over the next few years.

Formica Journal

The first number of a quarterly journal with the title of "Formica Industrial Journal" has been issued by Formica, Ltd. (a subsidiary of the De La Rue Co., Ltd.). The journal is intended to keep the electrical industry informed of the company's products, which include Formica industrial laminates for electrical insulation. The first issue gives details of the electrical and mechanical properties of a selection of insulation materials for busbars and gives particulars of some of the uses of Formica industrial laminates.

Diesel Locomotive Manufacture in South Africa

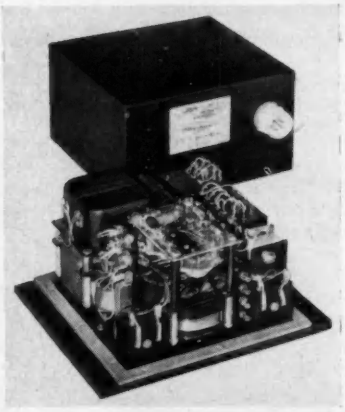
The Union Carriage & Wagon Co., Nigel, Transvaal, has concluded an agreement with the General Motors Corporation to manufacture General Motors diesel-electric locomotives in South Africa. The locomotives will be built at the new Nigel works. Only diesel-electric equipment and controls will be imported to meet customers' specifications and requirements. All other parts will be manufactured in the Union. The range available will be from 650 to 1,950 h.p.

Heating Systems for Traffic Ramps

One of the many uses of Panelec rewirable heating systems (Panelec (Great Britain), Ltd.) is in the new Lex Selfridge Garage off Oxford Street, London. A heating system has been installed beneath two of the three traffic ramps, one leading from the street to a first floor garage and the other providing goods vehicles with easy access to the loading bays. The system is thermostatically controlled and will operate automatically when the temperature falls below freezing point, thus preventing ice from forming on the ramp at any time. The system can also be switched on manually before the temperature falls to freezing point, as for instance when snow is expected. The installation was carried out by J. H. Plant, Ltd., electrical contractors, of St. Martins Lane, London, to the design of Selfridges Engineering Department.

Static Power Invertor

A static power invertor, utilising transistor and magnetic amplifier circuitry to convert an 18-30 V d.c. supply to provide a 115 V, 400 c/s, single-phase a.c. source, has been developed by Magnetic Amplifiers, Inc. of New York. Designed to produce a stable power output of 80 VA, the unit was created for use in missiles, aircraft and ground equipment but it also has industrial applications in the fields of automation, atomic energy programming, and in ignition systems. Its output is stabilised in voltage and frequency for wide variations of input voltage, load, load power factor and ambient temperature.



A compact invertor

The invertor has a vibration range of 10 to 2,000 c/s, will withstand variable input voltages up to 40 V, and may be repeatedly switched on and off without generating frequency transients or causing damage. Other features include a regulation of 1½ per cent for load variations from no-load to full-load; a maximum distortion of 5 per cent; and manual adjustment of the output from 105 to 125 V and frequency control in a range of ±3 c/s.

Electricity Supply Handbook

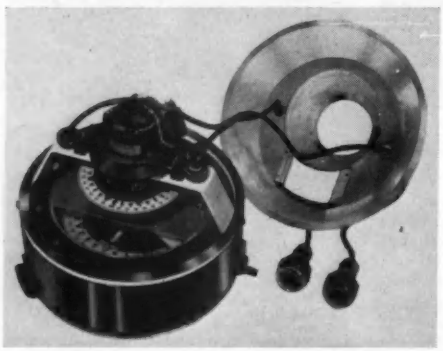
The "Electricity Supply Handbook 1959" is now available from the *Electrical Times*, Sardinia House, Sardinia Street, London, W.C.2, price 10s. This latest edition, the twelfth in the series, follows its predecessors in general arrangement but some minor alterations have been made. Changes in the organisation of certain Area Boards during the past year have necessitated not only rearrangement of

the text but also the complete re-drawing of the Area maps.

The 1959-60 bulk supply tariff has been published in time for inclusion in the section relating to standard electricity tariffs, which incidentally contains an additional table of published off-peak rates. Other useful information contained in the 215 pages of this book includes sections dealing with the Electricity Council; Central Electricity Generating Board; all the Area Boards; the Atomic Energy Authority; Government Departments; and voltages in the British Isles. In addition, there are maps showing the boundaries of Areas, Sub-Areas and Districts, with addresses of headquarters and service centres. A pocket on the inside back cover contains a three-colour folding map showing generating stations and transmission lines as at April, 1958.

Transmitting Magnetic Compass

A transmitting magnetic compass introduced by Kelvin & Hughes (Marine), Ltd., which enables any number of repeaters to be operated from the standard magnetic compass, has completed sea trials over a period of nearly five years, and has been fully type-approved by the Admiralty compass observatory at Slough for use as a ship's standard navigational compass.



The detector and servo motor mounted on the underside of the compass bowl

The equipment consists of a conventional standard magnetic compass of the non-resonant-suspension liquid type with a detector unit fitted to the underside of the bowl which can register compass card movements of less than ½ deg. This unit detects the ship's movement about the compass card and a servo motor keeps the detector constantly aligned with the magnetic system. The same servo motor is connected to a transmitter controlling various repeaters throughout the ship.

Up to four repeaters can be operated from the standard transmitter, a small extra unit being necessary if more than four are required, and the repeaters can be fitted in any convenient location without regard to surrounding magnetic influences, by which they are completely unaffected. In addition the compasses can be used to stabilise radar displays and direction finding bearing scales.

Nuclear Metals

A new booklet published by I.C.I. Metals Division details the part which I.C.I. played in the early days of nuclear engineering and the intensive research and development work which it has subsequently carried out in this field, both as regards new forms of traditional materials and fabrications and in the realm of the nuclear metals. The booklet contains data sheets on various metals and a representative bibliography.

Electrical Handbook

An entirely new edition of the "Crabtree Electrical Handbook" has been published by J. A. Crabtree & Co., Ltd. The introduction of new wiring materials and methods; the appearance of many new British Standards; changes in regulations; the extensive developments in Crabtree wiring accessories and protective and automatic control gear—are all reflected in this third edition. A number of sections have been added and the reference tables have been expanded. As a result, the handbook now runs to 424 pages.

The latest pocket book edition is lighter and considerably less bulky than its predecessor which appeared more than twelve years ago. This has been achieved by the use of a new kind of bible paper and a plastic binding which is both thin and tough. It has been published at the nominal price of 5s net and may be obtained through booksellers or from the head office of the company at Lincoln Works, Walsall, Staffs.

Marconi Equipment for U.S.

A contract valued at $3½ million has been placed by the United States Government with Marconi's Wireless Telegraph Co., Ltd., with whom are associated the Automatic Telephone & Electric Co., Ltd. The order calls for the supply of a mobile microwave telephone and telegraph communication system linking many of the United States Air Force bases in the United Kingdom. The system is planned as a number of mobile stations, each of which will be self-contained with all the necessary equipment, including its own power supply.

The radio equipment to be employed is the new Marconi Type HM510 series, which operates in the 4,000 Mc/s band. The system is capable of carrying 240 telephone channels. This equipment employs an English Electric Valve Co. travelling-wave tube as the final stage in the transmitter, giving a power output of 2 W. The telephone carrier equipment will be provided by the Automatic Telephone & Electric Co. The telegraph channelling equipment will be provided by the Telephone Manufacturing Co., Ltd.

Other manufacturers associated with Marconi's in this project are:—Austinlite, Ltd. (diesel alternator sets); Hands (Letchworth), Ltd. (vehicle chassis); Bonnallack & Sons, Ltd. (vehicle bodywork); Access Equipment, Ltd. (mast equipment); and Thermocontrol Installations Co., Ltd. (air conditioning).

Instrumentation Exhibition

James Gordon & Co., Ltd., is holding an exhibition of instrumentation and automatic controls for boiler plant, furnaces, heating installations, steam supplies, etc., on 14th, 15th and 16th April at Victoria Station Hotel, Nottingham.

Works Engineers' Course

The Regional Council for Further Education for the South West informs us that the residential course for works and plant engineers which was to have been held in Bristol from 6th to 10th April, has been cancelled.

"Crofts Country"

Crofts (Engineers), Ltd., Bradford, have sent us a copy of "Crofts Country," a map of the northern half of the country showing pictorially some of the country mansions, castles and other places of interest, with trunk and other roads clearly marked.

Trade Announcements

The Sheffield branch of **Communication Systems, Ltd.**, has moved to 27, Collegiate Crescent, Sheffield. Mr. J. L. Campbell is manager.

The automatic tripod safety signals made by the **Martindale Electric Co., Ltd.**, Westmorland Road, N.W.9, will in future be sold directly instead of through a distributor.

As from 6th April the registered office, transfer office and Accounts Department of **Vent-Axia, Ltd.**, will be transferred to Fleming Way, Crawley, Sussex (telephone: Crawley 26062).

Law & Plumtree have closed down their office at 6, Lansdowne Road, Erdington, Birmingham, and also their other branches, and have centralised their activities at "Glenholme," Holme Road, Matlock Bath, Derbyshire.

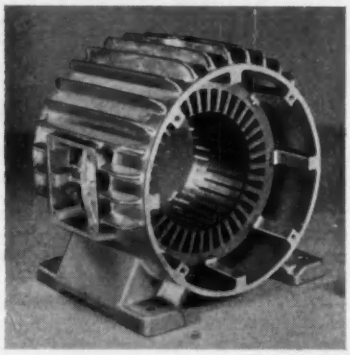
Mr. R. W. Honeywell has recently been appointed representative for the Leicester area by **Crofts (Engineers), Ltd.**

Change of Name

Davis & Thompson, Ltd., has changed its name to Datum Metal Products, Ltd. This title bears a closer relationship to its activities, which cover the design and manufacture of the "Datum" series of instrument racks, cases, control consoles, chassis and panels.

Developments in Motor Manufacture

IMPROVED DIE-CASTING TECHNIQUE FOR STATOR CONSTRUCTION



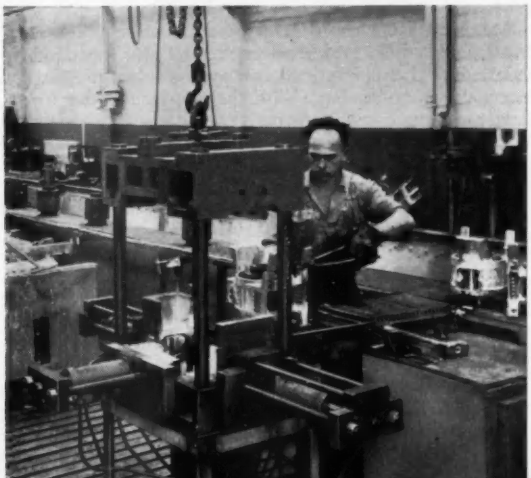
The die-cast stator core of a 7½ h.p. 2,860 r.p.m. totally enclosed motor showing the laminations cast in position

THERE are two conventional methods in use for producing induction motor stators for motors from ¼ to 10 h.p. One method is to bore through a cast-iron stator frame, assemble the stator laminations, and secure them by a clamp ring. The other method is to press into the machined bore of the frame a riveted or welded stack of stator punchings and to secure it by dowelling.

Another, new, method, involving the application of die-casting techniques, was first adopted on small machines by the British Thomson-Houston Co. in 1946. Basically, the method consists of casting the stator frame around the laminations, thus providing a one-piece die-cast frame and core assembly. After machining and winding, the assembly of the motor is completed by the addition of a cast-aluminium squirrel-cage rotor and die-cast end-shields and bearing caps. Thus, with the exception of the stator windings, shaft and certain minor parts, the motor constructed in this way is wholly made up of die-cast components. This method has proved eminently successful, and its advantages both in manufacture and operation have been effectively demonstrated by service experience over the past twelve years.

As a result, the technique has been adopted for larger sizes of machine. To meet this, the company's Birmingham works has been considerably extended to provide capacity for the mass-production of British Standard dimension motors (drip-proof and totally enclosed fan cooled) with die-cast construction. Typical ratings which now incorporate this method of construction are 7½ h.p. at 2,860 r.p.m. (totally enclosed fan cooled) and 10 h.p. at 2,860 r.p.m. with ventilated enclosures.

Industrial motor manufacture at the B.T.H. Birmingham works showing the die-casting of the stators



The use of cast squirrel-cage rotors and "cast-in" stator laminations enables the number of separate parts per machine to be kept down to the minimum, with a consequent saving in storage space. In addition, the machining time for the stators is considerably reduced by the elimination of the machining of the bore to receive the laminations.

The punchings are first assembled on a mandrel, which then forms part of the gravity casting die, and a silicon aluminium alloy is cast around them. The location of the mandrel in the die ensures perfect concentricity between the frame and the bore of the laminations, and an even thickness of metal is obtained for the subsequent machining of the endshield fixing spigots. By this means, the punchings are securely held, and any tendency to axial "springiness" or actual movement of the punchings, such as can occur with end-ring fixing, is prevented. Furthermore, the intimate contact between the punchings and the cast metal of the frame permits better heat transfer from the core, the improved heat conductivity of the aluminium alloy ensuring that heat from the machine is more quickly dissipated.

Reduced Weight

Another advantage of aluminium alloy is its lower weight compared with cast iron and this, together with the fact that die-casting permits thinner metal sections to be used, gives a higher output-to-weight ratio—a particularly important feature for some motor applications. Furthermore, the greater uniformity of wall sections and metal densities, and the reduced possibility of porosity and hidden blowholes, enables a more economic use to be made of the material, while the elimination of sand cores results in a greater consistency of shape and better matching between frame and end-shield. Motors manufactured by this method are notable for their clean lines and smooth surfaces, and the special "Pylumin" solution treatment provides a suitable surface for subsequent paintings.

A further important feature is in the use of silicon aluminium alloy. This is specially chosen for its strength and corrosion resistance and its complete suitability as a die-casting metal. Compared with cast iron, this alloy has the additional advantage of greater toughness, making it less likely to suffer damage in service or during transportation.

Floor Warming Installation Technique

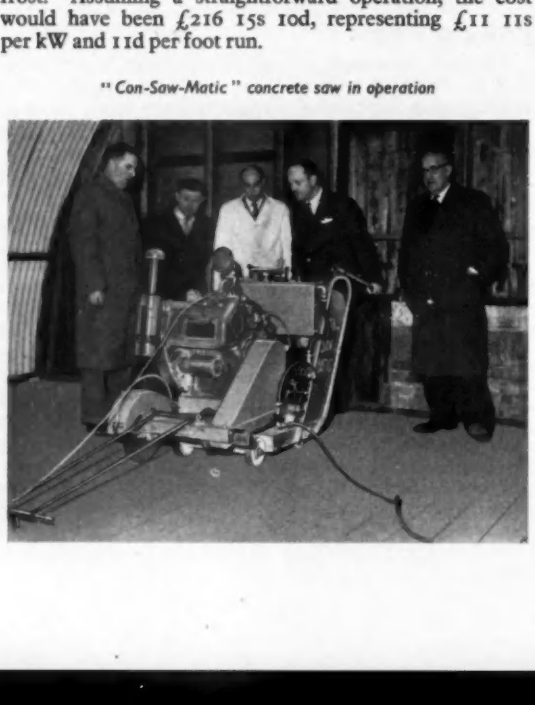
A METHOD of installing floor warming cables in existing floors without raising their level has recently been tested by the South Eastern Electricity Board. This was done because information was received from Mr. C. T. Nichols, engineer and manager, Melbourne City Council Electricity Department, that he had tried out a British machine for cutting slots in existing concrete floors.

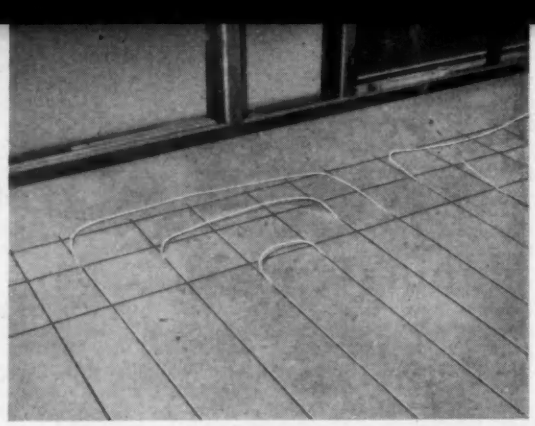
A large Nissen hut at Orpington was selected for the trials. It had a substantial granolithic concrete floor which had been laid about ten years ago and was hard and well cured. By arrangement with the Clipper Manufacturing Co., Ltd., manufacturers of the "Con-Saw-Matic" power-driven concrete saw, a machine was borrowed for the period of the tests. This machine is self-propelled with an infinitely variable speed of traverse. The cutting edge of the saw blade is cooled by direct application of cold water. The machine has a dashboard which provides for the operator finger-tip control of cutting depth, speed of traverse, water supply and an indication of depth of cut.

The slots for the heating cables were 1½in deep by ⅜in wide and 6in apart. The installation of the "Flora-warm" plastic insulated cables was rapid. When held at one end of a cable slot and stretched along the slot to the far end, the cables literally fell into position. Since the strength of the floor was not impaired by the narrow slots, a cement slurry was used to infill after the cables were laid. Finally, a machine was used to grind the floor surface flat to produce a finish suitable for a social club room.

The cost of installing 18·75 kW of heating worked out at £311 5s 6d. This represents an average price per kW of £16 12s and an average cutting cost of 1s 4d per foot run. These costs, however, include setting up the machine and water supply, test runs and a failure due to frost. Assuming a straightforward operation, the cost would have been £216 15s 10d, representing £11 11s per kW and 11d per foot run.

"Con-Saw-Matic" concrete saw in operation





Method of installing cables in the slots cut in the concrete

Bearing in mind the experimental character of the installation and the particularly hard floor, and on the assumption that an electrically-driven saw was available, it is believed that subsequent installations could be carried out at a considerably reduced cost. The South Eastern Electricity Board has worked out that, for an installation such as that described above, the cost would be £189 10s 4d, which represents an average price per kW of £10 and a cutting cost of 10d per foot.

B.E.P.C. Arrangements

AT a meeting in London last week held under the auspices of the British Electrical Development Association, which is responsible for the publicity side, particulars were given of the arrangements for this year's British Electrical Power Convention (Torquay, 1st to 5th June). Mr. W. N. C. Clinch, chairman of the E.D.A. Council, presided and introduced Mr. C. R. King, the Convention president. After paying a tribute to the work of E.D.A. under its director, Mr. J. I. Bernard, Mr. King stressed the all-industry nature of the Convention and said that its theme, "Electricity and its Contribution to the Standard of Living" would enable the papers read at the Convention to range over a very wide field of electrical progress.

Mr. King went on to give some statistics of the electrical industry's rapid advance and he particularly mentioned the small increase in the average cost of electricity in comparison with the rise in all other costs. A greatly increased demand for all types of domestic electrical appliances had resulted from the reduction of purchase tax and the easing of restrictions. That demand would be accelerated if purchase tax was further reduced or abolished.

Mr. Clinch thanked Mr. King and then spoke of the important part which the exhibition played in the Convention. It not only enabled the public to see what electrical appliances were available but also afforded a "platform" on which delegates could meet. He asked for full support to be given to the firms which were participating.

He then introduced the authors of the papers to be read at the Convention who were with him on the platform—Messrs. F. H. S. Brown and J. Henderson ("Progress on the First Nuclear Power Stations"), Mr. C. C. Hyams ("The Scope of Installation Engineering"), and Mr. E. J. Sutton ("The National Inspection Council for Electrical Installation Contracting"). Mr. A. N. Irens ("Priority One: The provision of a reliable supply of electricity at a constant voltage and at the cheapest possible price to all who want it") was delayed but arrived before the conclusion of the meeting. Mr. O. W. Humphreys ("Lighting and the Common Weal") was unable to be present.

Markets for Nuclear Power Stations

THE IMPORTANCE OF POLITICAL AGREEMENTS

THE prospects for British exports of nuclear reactors and equipment "depend not only on the competitive ability of British firms but also on the political agreements that the Government is able to make. Marketing nuclear reactors is not purely a commercial undertaking but also involves international politics. Unless this is clearly understood British chances of building up an export trade will be small."

These statements are made in a broadsheet "Prospects for Nuclear Power" published by Political and Economic Planning, 16, Queen Anne's Gate, London; price 2s 6d.

The broadsheet explains why fulfilment of the promise that nuclear energy will eventually provide all nations with an unlimited and virtually indigenous supply of energy at an economic cost, lies well in the future.

Electricity can be produced economically only in the large nuclear reactors at present available when it can be fed at high load factors into a fully developed grid. Nuclear energy is unlikely yet to help under-developed countries or be suitable for the direct production of heat, where small units are normal. The availability of fossil fuels and the growing diversity of sources of energy also limits its immediate contribution in many more highly developed countries, including the United States. It is pointed out that even in Europe, where the prospects for its use are brightest, nuclear energy is suitable for the production of electricity only in conditions to which the growing quantity of small coal is also particularly suited. Another difficulty in the way of the rapid expansion of the use of nuclear power is that electricity "is not, at present costs, an economic substitute for other sources of energy for many purposes."

Small Reactors

After reviewing developments and plans in various countries, the broadsheet says that it is clear that there is, or will be, an export market for nuclear power reactors. For the moment the market will be for reactors of over 100 MW. These are the only ones which have been sufficiently proved for both exporting and importing countries to have confidence in them and for which accurate capital and operating costs can be given. There is also a potential market for a small reactor, similar to that for gas-turbine and diesel powered generating sets. If the high cost of these reactors could be reduced they could transform areas now undeveloped.

In industrial countries nuclear power is the best answer to the long-term problem. The export market therefore is necessarily confined for at least the next ten years, to European countries, Japan, and possibly some countries of Latin America. Potential sales are, however, lessened by the fact that these countries are also able to make much of the equipment necessary.

The prospects for British firms to export reactors are probably "not so bright as they were once thought." Most of the possible customers want to develop their own atomic industry as soon as possible. They may import one or two reactors, as Italy has done, to gain experience of construction and operation, but after that they will probably do more and more of the work themselves. Some may set up a fuel element manufacturing plant, but probably not a fuel processing plant.

In Spain, Portugal and the Scandinavian countries, which can afford atomic electricity but do not appear to place much importance on being self-sufficient, American competition will be fierce. Some thirty American firms have already begun to co-operate in a publicity project called "USatom." Whether British or American reactors are bought it seems clear, the broadsheet goes on, that the future of the nuclear reactor export market must of necessity be closely tied to a successful small reactor. The development of nuclear energy also means an increased demand for the ancillary products, turbo-generators, handling gear, processing equipment, and instruments, which British firms can supply as cheaply as any of their competitors.

Since British efforts have been concentrated on the Calder Hall type reactor, it is concluded that Britain is not so favourably placed as the United States to design reactors for special conditions. The United States is also at present the only country that can supply enriched fuel for reactors abroad. Britain is taking steps to enable her to meet the demand for small reactors. So far the Soviet Union has not been active in export competition, concentrating mainly on Eastern Europe and China. But she may become so, and like the United States have an advantage over Britain in the matter of reactor types.

Contact Rectifiers

MECHANICAL contact rectifiers have in recent years been introduced on a steadily increasing scale, mainly for supplying heavy currents at relatively low voltages for electrolytic processes. The specific advantages of this type of rectifier are its high efficiency (97 per cent or more), absence of backfire and the simple and cheap replacement of contact elements damaged by short circuits. The initial difficulties with commutation have been overcome and the short-circuit currents are effectively damped by the commutating reactors used.

The commutation processes can be improved still further and the layout of the contact rectifier simplified by arranging germanium or silicon rectifiers in parallel with the working contacts. Since these elements may carry short-time loads of the order of some kA during commutation periods, this represents an efficacious protection of the working contacts. However, care should be taken that the instantaneous current at cut-off does not exceed about 30 A. This can be obtained by judicious arrangement of the commutating reactor stages.

The main advantage obtained is that arcing is practically eliminated, even if the working contacts open prematurely under overloads or double earth faults on the a.c. side. This confers on the contact rectifier some of the desirable "valve" or "switch" characteristics possessed by the conventional rectifier types. Germanium and silicon rectifiers are very suitable as "rectifier-shunts," but not selenium rectifier elements because their current density and inverse voltage strength are insufficient.—"Contact Rectifiers with Heavy Current Shunts," F. Koppelmann, *ETZ-A*, Vol. 79, No. 21, pp. 793-797, 1st November, 1958, in German.

GENERATION and DEVELOPMENT

London Restricted-Hour Tariffs

Leaflets have been issued by the London Electricity Board giving details of its restricted-hour tariffs for electricity supplied exclusively for thermal storage purposes. A charge of 10s a quarter is made for metering equipment, including time-switch, and where the loading exceeds 20 A the consumer is required to provide a suitable contactor. The tariffs available are as follows:—

Domestic Rate.—(i) Supply available only between 10 p.m. and 7 a.m., 0·85d/kWh. (ii) Between 10 p.m. and 7 a.m. and any three hours between 11 a.m. and 4.30 p.m. from time to time specified by the Board, 0·9d/kWh. (iii) As (ii) but between 7 p.m. and 7 a.m., 0·95d/kWh.

Non-Domestic Rate.—(i) Supply available between 10 p.m. and 7 a.m. and between noon on Saturday and 7 a.m. the following Monday. Installed load not exceeding 20 kW, 0·85d/kWh; installed load exceeding 20 kW, 0·5d/kWh subject to adjustment of 0·00063d/kWh for each penny variation in fuel cost from 60s a ton. (ii) As (i) but from 7 p.m. to 7 a.m., 0·9d and 0·55d respectively. (iii) As (ii) but with supply also available during any three hours between 11 a.m. and 4.30 p.m. from time to time specified by the Board, 0·95d and 0·6d.

Pembrokeshire Reinforcement

As part of its plan for the electrical development of West Wales, the South Wales Electricity Board recently laid a 33 kV cable across Milford Haven. The work, which was carried out by British Insulated Callender's Cables, Ltd., formed part of the last stage of a development scheme involving the whole of South Pembrokeshire.

At present the main supply to the area is provided by a 132 kV line from Carmarthen, with secondary distribution at 33 kV over two lines from Haverfordwest to Steynton, near Milford Haven, and from Haverfordwest to Pembroke via Tenby. The new scheme, of which the submarine cable forms part, will link Pembroke and Steynton, thus creating a transmission ring which will ensure adequate power supplies at each end of the major urban areas en route. In the event of a technical fault developing on any portion of the ring, the faulty section will be automatically disconnected without interrupting supplies to the area generally.

The final link up of Pembroke and Steynton will cost £42,000, including £8,000 for the submarine cable. The cable, approximately 750 yd long and 4½in in diameter, is protected by continuous lead sheathing and steel wire armouring; its weight is approximately twenty tons, and the total cost of the cable and laying works out at something over £10 per yard.

The South Wales Board's decision to lay the cable under water was made at the request of the Pembrokeshire National Park Committee in order to preserve the amenities of the district.

Cable-laying in progress at Milford Haven

Folkestone Station to be Closed

The sixty-year-old generating station at Morehall, Folkestone (output capacity 4 MW) is to be closed down this year, probably in July, it is announced.

200 MW Sets for Kincardine

The South of Scotland Electricity Board recently announced the placing of contracts for the completion of the Kincardine generating station (see *Electrical Review*, 27th March, page 614). The plant includes two 200 MW turbo-generators to be supplied by the General Electric Co., Ltd., which are the largest so far ordered for a Scottish power station. The turbines will be designed for steam conditions of 2,350 p.s.i.g., 1,050 deg F with reheat to 1,000 deg F, vacuum 28·9in with 55 deg F cooling water temperature. The feed heating will be in seven stages to a final feed temperature of 460 deg F. The generators will be hydrogen cooled at a pressure of 50 p.s.i.g., and will have an output of 235 MVA, 0·85 p.f., 3-phase, 50 cycles at 16 kV. The generator rotors will have hollow conductors direct-cooled by the hydrogen — the same arrangement as adopted for G.E.C. machines already in service with a hydrogen pressure of 30 p.s.i.g. The stator conductors will be liquid cooled.

South Wales Industrial and Off-Peak Tariffs

With effect from 1st April, the South Wales Electricity Board has introduced an alternative scale of charges available to industrial consumers who take their supplies under maximum demand tariffs. The alternative tariff has higher m.d. and lower "unit" charges than the existing tariff, which remains available for the time being. Industrial maximum demand consumers with good load factors are therefore likely to find it beneficial to transfer to the new tariff. It is indicated that towards the end of the present year there is a probability that the existing scale of charges for industrial maximum demand consumers will be withdrawn and all consumers charged in accordance with the alternative scale.

The power factor adjustment clause of the Board's industrial tariff has also been amended from 1st April.

A new restricted hour off-peak tariff has been introduced under which the charge varies from 0·52d (plus fuel adjustment) to 0·725d per kWh according to the type of supply and periods of use. There is no maximum demand or primary charge under the new tariff.

All-electric Maisonnettes in Manchester

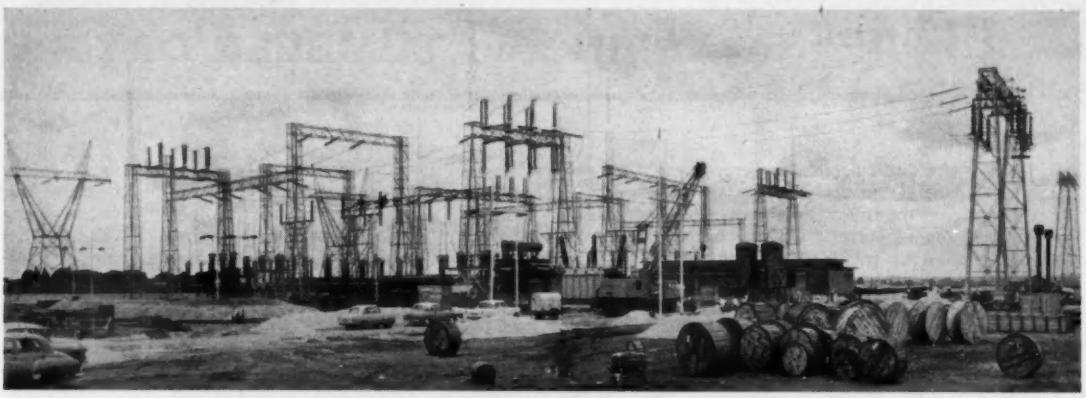
Manchester Housing Committee is to build 122 maisonnettes at St. George's, and has agreed that 98 shall be all-electric, with floor heating for the living rooms and halls, and that 24 shall have gas heating and other services apart from lighting and power.

OVERSEAS

330 kV Substation in Rhodesia

To enable power to be interchanged between the systems of the Electricity Supply Commission of Southern Rhodesia and the City of Salisbury, whose peak loads occur at different times, the Federal Power Board recently commissioned a 21-mile 330 kV transmission line between Norton and Salisbury. This line will form part of the 330 kV network fed from the Kariba power station and it operates at the highest voltage yet employed in the Southern Hemisphere.

Substation equipment being supplied by the British Thomson-Houston Co., Ltd., and Ferranti, Ltd., on their main Kariba contracts has been brought forward by more than a year to enable this temporary interconnection to be made. The accompanying photograph shows erection work in progress at Norton substation, where a Ferranti 330/88 kV, 60 MVA transformer, and



General view of the Norton substation, Southern Rhodesia, the first commissioned at 330 kV in the Southern Hemisphere

a section of the 330 kV substation equipment and associated apparatus supplied by B.T.H., are now in service. Messrs. Merz & McLellan are the consulting engineers to the Federal Power Board.

Cheaper Electricity in Sydney?

Our Australian correspondent reports that the Sydney County Council decided on 11th March to consider a reduction in electricity charges. The 1958 accounts submitted to the Council showed a total revenue of £25·5 million and a trading deficit of £345,944 against the budgeted deficit of £684,291. Mr. C. E. Ranger, the general manager, said the improvement was caused mainly by a substantial increase in electricity sales which was in sharp contrast to the moderate increase in 1957.

The average price of bulk electricity sold by the Electricity Commission this year is expected to be the lowest for six years, resulting in a saving of £1,250,000 to distributing authorities, the chairman, Mr. H. G. Conde, said recently. The basic energy rate was reduced by 0·05d per kWh from January last. This was made possible by increased efficiency and the policy of siting major power stations on the coalfields. Mr. Conde said, assuming that the delivered cost of coal, particularly to the new stations on the coalfields, continued to fall, and that increasing benefits were obtained from the growing proportion of power from the coalfields stations, the outlook was for progressive reduction in the price of power.

Swedish Board's Jubilee

The Swedish State Power Board has during the past month celebrated its fiftieth anniversary and its jubilee year will be marked by the putting into operation of five large power plants, two of which will be the biggest of their type ever completed in Sweden.

The Stenungsund underground thermal station, on the west coast, will have an initial capacity of 300 MW and work is proceeding on the blasting out of two more rock halls which will accommodate two additional boilers and steam turbines, making the total capacity 700 MW. The commissioning of the first stage of the installation is to take place on 1st October.

Sweden's largest hydro-electric plant, Stornorrfors, which will have a capacity of 375 MW (three 125 MW sets), will be officially inaugurated on 1st September. The first two turbines have been running for some time, and a third is now being installed. Two more water-power plants, Järkvissle and Langbjörn (87 MW and 80 MW respectively), will start operating in the summer and autumn.

The fifth power station is the 40 MW gas-turbine plant at Västervik, on the east coast, which will be brought into commercial service on 1st October.

During the year the transmission systems of Sweden, Norway and Finland will be interconnected so that surplus power can be utilised where it is most needed.

Swedish Atomic Power Projects

Five atomic plant projects are at present under development by the atomic power division of ASEA, according to a report by the Stockholm *Svenska Dagbladet*. They include three plants for AKK (a combine of eight large Swedish power producers and consumers), two of which are reported to be boiling water reactors using enriched uranium.

For the R3/Adam heat and power plant now under construction at the Stockholm suburb of Farsta by AB Atomenergi and the Swedish State Power Board, ASEA is serving as co-ordinator of detailed designs and as main supplier of components in collaboration with NOHAB and other Swedish companies. It has also received a preliminary commission to design a 200 MW water-cooled reactor for the State Power Board's R4/Eva project. The Swedish atomic programme has so far been based on the use of natural uranium as fuel and heavy water as coolant and moderator.

Uganda Brochure

To make its services known to non-English-speaking Africans, the Uganda Electricity Board has published a 12-page illustrated brochure in Luganda, the chief native language of the country. The pamphlet relates, in simple terms, the uses to which electricity can be put, and tells briefly of the growth of the Board's activities since its inception in 1948, and its plans for the future. It explains the action to be taken to obtain a supply of electricity, and addresses and telephone numbers of the Board's offices are listed. The brochure is being distributed to schools, local government headquarters, community centres and other places in Luganda-speaking parts of the Protectorate.

Street Lighting Notes

A new street lighting system costing £63,000 has been installed along 12½ miles of main roads at **Feltham,** Middlesex, replacing the former gas lighting. The installation consists of 513 G.E.C. tapered "Three-Eighty" fluorescent lanterns each housing "Osram" 5ft 80 W tubes and mounted on Stewarts & Lloyds steel columns; and 97 G.E.C. Z9465 totally enclosed lanterns housing 140 W integral sodium lamps, mounted on existing gas lighting standards. The fluorescent lanterns are carried at 12½ deg above the horizontal on special arc brackets. With the exception of the Venner time switches in the base compartments of the columns, all the control gear is housed within the lantern bodies. Along Faggs Road, part of which lies close to London Airport, the lanterns have a special cut-off light distribution to avoid confusion with the airfield lighting system.

Market Harborough U.D.C. is to install 254 electric street lamps to replace 115 gas lamps at a cost of £5,100.

Wells City Council is considering a scheme for improved lighting of the main traffic routes.

Padiham U.D.C. is to proceed with a £4.000 scheme for the conversion of the remaining gas street lamps to electricity.

Darlington Corporation is expected to spend about £10,000 on electric street lighting improvements during 1959-60.

Stockton-on-Tees Town Council has received sanction to borrow £9,457 for the lighting of Norton High Street and Bowesfield Lane.

Penge U.D.C. expects to save £1,000 a year in running costs by converting the lighting of side streets from gas to electricity. The estimated cost of the work is £30,000.

Smethwick Corporation is seeking the Ministry of Transport's approval of a scheme for further street lighting conversion from gas to electricity. The estimated cost is £52,500.

DOMESTIC ELECTRICAL EQUIPMENT

SPIN and TUMBLER DRYERS

LESS than five years ago there were virtually no spin dryers on the market in this country, whereas today, as will be seen from the following survey, there are almost 30 different manufacturers. What is perhaps more surprising is that this relatively new domestic appliance, apart from rapidly becoming regarded as an essential item of home laundry equipment, is also establishing sales in excess of those of washing machines. Reliable sales figures are not easy to obtain, but twelve months ago when fewer makes were available spin dryers were said to be selling at the rate of 250,000 a year. It has also been reported that several German washing machine manufacturers have either discontinued, or are proposing to discontinue, fitting power driven wringers to their products in view of the preference for spin dryers. So far, however, there are no indications that spin dryers have affected washing machine design in this country.

A spin dryer's function is not, despite its name, to dry clothes. It does, however, within approximately four minutes, sufficiently damp-dry a load of wet washing ready for ironing. It may be of interest to note that running the machine for a period longer than the usual four minutes will not in any way further dry the clothes. The drying action is achieved by placing the wet washing into a drum, which is spun at high speed (average 2,000/2,500 r.p.m.) and the pressure created between the clothes and the wall of the drum squeezes out the water through perforations in the side or slots let into the base. In this way the spin dryer differs from the tumbler dryer, in which air is drawn over a heating element by a fan and circulated through the clothes in a drum revolving at a much lower speed (approximately 45/50 r.p.m.). Spin dryers have also been combined with washing machines as a single unit.

Manufacturer or Distributor	Name or Model	Type	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Heater Loading and/or Motor Rating	Drum Speed	Exterior Finish
ACME DOMESTIC EQUIPMENT, LTD., David Street, Glasgow, S.E.	"Acme"	Spin	27½ × 14⅝ × 14⅝	6 lb	Motor: 240 W	2,400 r.p.m.	White or cream
ADA (HALIFAX), LTD., Johnson Street, Halifax.	"Adamatic"	Combined washing machine and spin dryer	33 × 30½ × 18	5 lb	Heater: 3 kW Motor: 200 W	2,700 r.p.m.	Cream or white stoved enamel
BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk.	"Felix"	Spin	25 × 17 diameter	8½ lb	Motor: 200 W	1,500 r.p.m.	White stoved enamel, turquoise trim
	"Bambino"	Spin	21½ × 14 diameter	6½ lb	Motor: 200 W	1,500 r.p.m.	White stoved enamel, turquoise trim
BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Goblin Works, Leatherhead, Surrey.	"Spin-Quick"	Spin	27½ × 16 × 16	6 lb	Motor: 320/340 W	2,800 r.p.m.	White stoved enamel
BURCO, LTD., Rose Grove, Burnley, Lancs.	"Tumblair"	Tumbler	36 × 21 × 20	5 lb	Heater: 1 kW (low) 2 kW (high) Motor: 200 W	52/54 r.p.m.	White/blue, white/maroon, cream/blue or cream/maroon
BYLOCK ELECTRIC, LTD., South Street, Ponders End, Middlesex.	"President"	Spin	22 × 14 diameter	6/7 lb	Motor: 140 W	2,800 r.p.m.	White with blue trim, chromium rim
CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks.	"Chilton"	Spin	24½ × 11⅞ diameter	3½ lb	Motor: 140 W	2,500 r.p.m.	White stoved enamel, red band, gold trim
CREDA (SIMPLEX ELECTRIC CO., LTD.), Creda Works, Blythe Bridge, Staffs.	"Debonair"	Spin	28½ × 15¾ × 15¾	6 lb	Motor: 240 W	2,800 r.p.m.	White or cream stoved enamel
CROWN APPLIANCES, LTD., 18, Gipsy Hill, London, S.E.19.	"Sentinel-Brocke"	Spin	23¾ × 14 diameter	5/6 lb	Motor: 240 W	2,900 r.p.m.	Lacquered and chromium plated
DRYMASTER, LTD., 192-196, Kensington Church St., London, W.8.	"Super Drymaster"	Spin	25 × 14 diameter	7½ lb	Motor: 100 W	2,200 r.p.m.	Cream stoved enamel, red trim

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1. Acme cabinet type spin dryer. **2.** *Bylock "President" spin dryer with transparent lid.* **3.** *British Vacuum Cleaner & Engineering Co.'s "Spin-Quick" cabinet type spin dryer.* **4.** *Creda "Debonair" spin dryer.* **5.** *Best Products "Bambino" (left) and "Felix" spin dryers.* **6.** *Crown Appliances "Sentinel-Brocke" spin dryer.* **7.** *Drymaster "Super" spin dryer.* **8.** *Chilton portable spin dryer.* **9.** *Burco "Tumblair" tumbler dryer*

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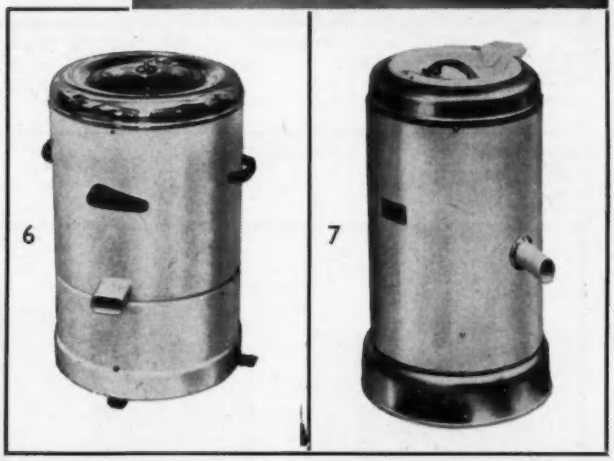

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Special Features	Price (excl. tax)	Purchase Tax
Automatic safety lid	£24 10 0	£5 7 6
Powered pump, plastic table top available, "Free-flo" rinsing	£69 6 7	£15 4 2
Quietness in operation, no-belt drive	£29 5 7	£6 8 5
Quietness in operation, no-belt drive	£24 19 5	£5 9 7
High-speed, quietness in operation	£25 16 8	£5 13 4
Adjustable heat control, thermo-static control, pilot lights. Castors 12s 9d extra	£44 18 0	£9 17 0
Transparent lid	£25 16 8	£5 13 4
Portability, easily stored	£19 16 1	£4 6 11
Safety locking lid, wheels for easy mobility	£26 5 6	£5 15 3
Transparent lid, foot brake	£28 10 0	£6 2 0
Extra-large tub, automatic switching by lid	£23 14 8	£5 2 10

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Manufacturer or Distributor	Name or Model	Type	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Heater Loading and/or Motor Rating	Drum Speed	Exterior Finish
EASICLENE PORCELAIN-ENAMEL (1938), LTD., Lord Street, Wolverhampton.	"Easiclene"	Spin	28×16½×16½	7 lb	Motor: 215 W	1,425 r.p.m.	Stove enamelled, range of colours
EDY (GREAT BRITAIN), LTD., Farnley Low Mills, Whitehall Road, Leeds, 12.	"Edy" C2(M)	Spin	28×13⅞ diameter	7 lb	Motor: 140 W	1,500 r.p.m.	White vitreous enamel
	"Edy" C3(M)	Spin	28×13⅞ diameter	7 lb	Motor: 140 W	1,500 r.p.m.	White vitreous enamel
ELLIOTT DOMESTIC APPLIANCES, LTD., Victoria Road, Willesden, N.W.10.	"Spin-o-matic"	Spin	25½×17 diameter	6/8 lb	Motor: 200 W	2,800 r.p.m.	White or cream, grey trim, red handles
ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, London, W.C.2.	4600 and 4601	Tumbler	36×26½×24½	8/9 lb	Heater: 2,750 W (4600) or 4 kW (4601) Motor: 200 W	48 r.p.m.	White or cream stoved enamel, aquamarine, lavender or candy pink top
FISHER & LUDLOW, LTD., Kingsbury Road, Birmingham, 24.	"Fisholow Aquaspin"	Spin	30×17×17	6/7 lb	240 W	2,500 r.p.m.	White with blue trim or cream with red trim
FRIGIDAIRE DIVISION OF GENERAL MOTORS, LTD., Stag Lane, Kingsbury, N.W.9.	"Cascade"	Spin	25×15×17	6 lb	200 W	2,800 r.p.m.	White or cream stoved enamel, grey trim
HOOVER, LTD., Perivale, Greenford, Middlesex.	"Hoovermatic" 3174 (heated) and 3444 (unheated)	Combined washing machine and spin dryer	31½×29½×16½	6 lb	Heater: 3 kW Motor: 240 W	2,000 r.p.m.	White stoved enamel, grey stoved enamel aluminium lid, blue base
	"Spinarinse" 3004	Spin	30½×13½×15½	6 lb	Motor: 350 W	2,000 r.p.m.	White stoved enamel, blue aluminium lid
KENWELL ELECTRIC, LTD., Meanwood Works, Spotland Bridge, Rochdale.	"Kenwell"	Spin	27½×15×15	6 lb	240 W	2,500 r.p.m.	White or cream stoved enamel, black base
R. & A. MAIN, LTD. (Electrical Division), 48, Grosvenor Gardens, London, S.W.1.	"Mainspin"	Spin	27½×16×18	6/7 lb	Motor: 200 W	2,400 r.p.m.	White stoved enamel with blue or grey fitments, or cream with green
MASTERMET PRODUCTS, LTD., Elmgrove Road, Harrow, Middlesex.	"Mastermet"	Spin	25½×17 diameter	6 lb	Motor: 200 W	2,600 r.p.m.	White or cream stoved enamel

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Special Features	Price (excl. tax)	Purchase Tax
Large capacity, foot pedal control	£26 15 2	£5 17 5
Rubber suction feet	£19 19 0	£4 6 6
Automatic brake when lid opened	£25 0 0	£5 8 3
Mounted on castors	£24 19 5	£5 9 7
Thermal cut-out, auto time control, mounted on castors	£52 10 6 (4600) £54 18 3 (4601)	£11 10 6 (4600) £12 0 11 (4601)
Fold-away drain outlet, tapered aluminium basket	£25 16 7	£5 13 5
Automatic cut-out device	£24 19 5	£5 9 7
Automatic pump operation, castors for ease of movement	£71 13 9 (3174) £67 6 10 (3444)	£16 2 8 (3174) £15 3 1 (3444)
Rinses as well as spins, pump emptied	£30 0 0	£6 15 0
Automatic pump	£22 0 0	£4 16 6
Automatic switch and brake	£24 19 5	£5 9 7
Interlocking switch, lid controls brake	£25 0 0	£5 8 4

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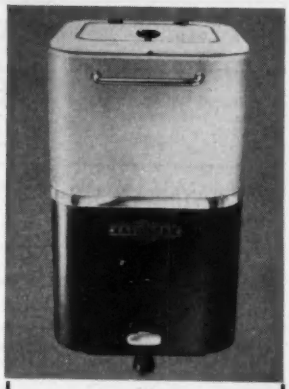

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10. *R. & A. Main "Mainspin" spin dryer*
11. *Elliott "Spin-o-matic" spin dryer*
12. *Frigidaire "Cascade" spin dryer*
13. *Mastermet Products spin dryer*
14. *English Electric model 4600 tumbler dryer*
15. *Kenwell cabinet type spin dryer*
16. *Hoover "Spinarinse" spin dryer*
17. *Fisher & Ludlow "Fisholow Aquaspin" cabinet type spin dryer*
18. *Easiclene cabinet type spin dryer*
19. *"Adamatic" combined washing machine and spin dryer*

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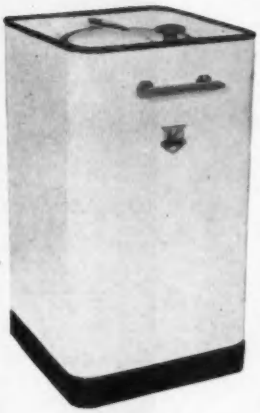

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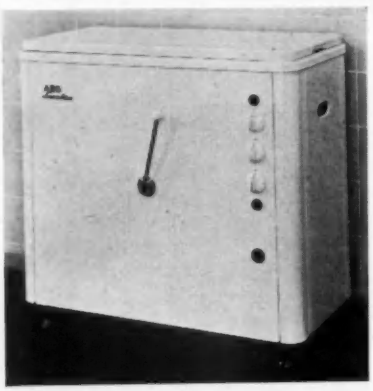
Manufacturer or Distributor	Name or Model	Type	Size (H. W. & D. in inches)	Clothes Capacity (dry weight)	Heater Loading and/or Motor Rating	Drum Speed	Exterior Finish
GORDON MILLER, LTD., 91, Beddington Lane, Croydon.	"Gordon Miller" Standard (a) and De-luxe (b)	Portable spin	12×14 diameter	5 lb	Motor: 200 W	1,450 r.p.m.	White stoved enamel, red trim
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1.	"Astral"	Spin	24⅜×15½×18⅜	7/8 lb	Motor: 200 W	2,200 r.p.m.	White or cream stoved enamel
NUTT ENGINEERING CO., LTD., Stapleford, Cambridge.	"Hayn Breeze"	Spin	23×12 diameter	6 lb	Motor: 200 W	1,420 r.p.m.	White stoved enamel
RADIATION, LTD. (Electrical Division), 255, North Circular Road, Neasden, N.W.10.	Parnall "Auto-Dry"	Tumbler	29×21⅜×20½	6 lb	Heater: 2,500 W Motor: 200 W	45 r.p.m.	White or cream stoved enamel, vitreous enamel top
W. & S. SUMMERSCALES, LTD., Parkside Works, Keighley, Yorks.	"Scales" SD2	Spin	27½×15¾×15¾	6/7 lb	Motor: 100 W	1,510 r.p.m.	White stoved enamel
THERMAIR DOMESTIC APPLIANCES, LTD., Tame Road, Witton, Birmingham, 6.	"Thermair"	Spin	26×15 diameter	6/7 lb	Heater: 1 kW Motor: 100 W	1,425 r.p.m.	White and cream stoved enamel
	"Saturn"	Spin	12×14 diameter	5½ lb	Motor: 100 W	1,450 r.p.m.	White and cream stoved enamel, red band and base
WELMEC CORPORATION, LTD., 147, Strand, London, W.C.2.	AEG "Lavalux"	Combined washing machine and spin dryer	32½×32½×19⅜	7 lb	Heater: 2 kW Motors: 550 W	1,600 r.p.m.	White or cream enamel, black stove enamelled base
	AEG	Spin	31×17×20	8 lb	Motor: 100 W	1,600 r.p.m.	White or cream enamel
WILKINS & MITCHELL, LTD., Darlaston, South Staffs.	"Rinspin"	Spin	31×17½×18	6 lb	Motor: 300 W	2,200 r.p.m.	White stoved enamel, grey trim



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Special Features	Price (excl. tax)	Purchase Tax
Foam rubber cushion (a) plus switch brake, hinged lid and extension hose (b)	£16 16 6 (a) £19 14 0 (b)	£3 13 0 (a) £4 5 6 (b)
Safety interlock, lid controls motor, foot brake, castors	£23 8 11	£5 1 7
Direct drive, narrow aperture drum	£20 15 3	£4 8 9
Automatic timer and door cut-out switch, fits under draining board	£38 0 0 £39 2 1 (with glass insert in door)	£8 11 0 £8 15 11 (with glass insert in door)
Direct motor drive to spinner, silent running	£26 8 0	£5 15 10
Heater in lid, gyroscopic stabiliser	£31 8 7	£6 17 11
Portability, stands on draining board	£17 18 9	£3 18 9
Copper spin-dryer drum, choice of "Formica" tops in six shades	£72 19 7	£16 0 3
Copper drum, stove enamelled lid	£26 5 5	£5 15 4
"Deep Rinse" water extraction, 2-purpose hose	£30 0 0	£6 15 0

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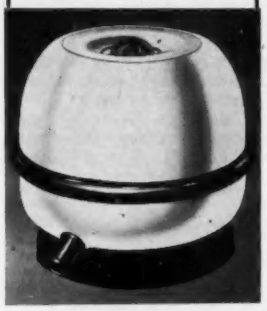

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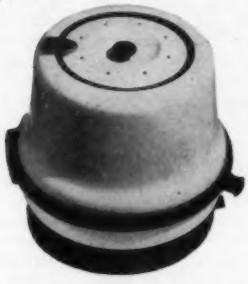

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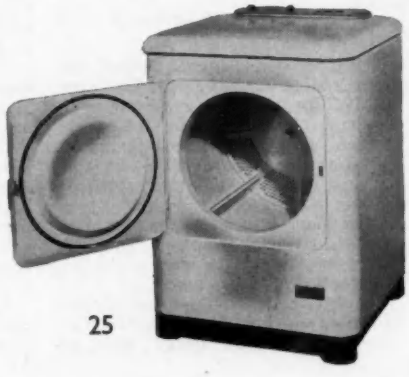

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20. *AEG "Lavalux" combined washing machine and spin dryer (Welmec Corporation, Ltd.)*
21. *Thermair heated spin dryer*
22. *Summerscales "Scales" model SD2 spin dryer*
23. *AEG spin dryer (Welmec Corporation, Ltd.)*
24. *Gordon Miller portable spin dryer*
25. *Parnall "Auto-Dry" tumbler dryer (Electrical Division of Radiation, Ltd.)*
26. *Thermair "Saturn" portable spin dryer*
27. *Wilkins & Mitchell "Servis" cabinet type spin dryer*
28. *Morphy-Richards "Astral" cabinet type spin dryer*

PARLIAMENTARY REPORT

Need for Street Lighting Uniformity

Yet another plea to the Government to take over the control of street lighting was made in the Commons during the roads programme debate. Mr. Arthur Moyle said that there were virtually 8,000 different lighting authorities. There was not a single expert authority who did not argue that the direct effect of improving street lighting by way of uniformity and continuity would mean a substantial reduction of road accidents during night time. It was a vital factor in traffic efficiency. Knowing the facts, he would have thought Mr. Watkinson was just the man to get the Government to support him in bringing order and efficiency out of the present deplorable field of confusion, inefficiency and chaos.

Mr. G. H. R. Nugent, Parliamentary Secretary, Ministry of Transport, when he wound up the debate, said that the Minister was aware of the problem and had been doing all he could to encourage lighting authorities to get together. He hoped that improvements would result, especially in the London area.

Weir Report

Commenting on the report of the Weir Committee on co-operation between Electricity and Gas Boards, Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, said that the main conclusion, after a careful investigation of the possibility that increased co-operation between the two industries in the performance of their statutory functions might improve the service which they give to the public, was that there was no case for major changes in existing arrangements. The Committee, however, made some useful recommendations designed to improve the services provided by the Boards which the Secretary of State for Scotland and the Minister of Power were commending to the attention of the electricity and gas authorities. The Government were most grateful to Sir Cecil Weir and to the other members of the Committee for their valuable report.

Nuclear Exports

Major Tufton Beamish asked the Prime Minister whether he was satisfied that the present system of supplying natural uranium for use in nuclear power stations, involving immediate payment for the fuel and a refund when the fuel was returned, was not placing British contractors at a disadvantage with foreign competitors, and to what factors he ascribed the recent British failure to get an order in Baden-Württemberg.

Mr. Butler, deputising for the Prime Minister, said that the Atomic Energy Authority expected to be able to arrange extended credit terms for the initial fuel charges for reactors sold abroad. It was unlikely that any practicable alteration in the terms for the supply of fuel would have affected the Baden-Württemberg decision.

Major Beamish said that American contractors appeared to have two major advantages—first, the fact that Euratom enjoyed a loan of $135 million; and second, that the American Government provided enriched fuel at a low interest. Were the Government doing everything possible to offset these advantages?

Mr. Butler: "I am aware of both the fuelling and the financial advantage which the U.S.-Euratom Agreement gives in tendering. I have no doubt that the Chancellor of the Exchequer will note Major Beamish's observations."

Purchase Tax and the Budget

Mr. Robert Cooke asked the Chancellor of the Exchequer what administrative action he had taken to ensure the collection of purchase tax, where due, on electrical equipment sold now in retail shops, in view of the fact that some of these shops were offering such equipment for sale now with the undertaking that a Budget purchase tax reduction would be refunded to the purchaser.

Mr. Erroll, Economic Secretary, said no special action was called for. The offers to which Mr. Cooke referred appeared to be an enterprising attempt by some retailers to overcome, at their own risk, any reluctance potential customers might feel to make pre-Budget purchases. The goods in question were tax-paid at current rates and there could, of course, be no question of a refund from the Exchequer in the event of a reduction in tax in the forthcoming Budget.

Scottish Rural Electrification

Mr. Neil McLean asked the Secretary of State for Scotland approximately how many crofts and farms would be connected this year to the North of Scotland Hydro-Electric system.

Mr. Macpherson said the North of Scotland Hydro-Electric Board expected 1,000 farms and 500 crofts to be connected to their system this year. Their report for 1958 showed that 12,789 farms and 3,266 crofts were already connected, and that 6,511 farms and 8,534 crofts still remained to be connected.

Electricity Borrowing Powers

In the House of Lords the Electricity (Borrowing Powers) Act received the Royal Assent.

Scottish Pumped Storage Scheme

THE first large-scale pumped-storage works in any of the Scottish hydro-electric schemes will form part of the new constructional scheme in Loch Awe district. This latest scheme of the North of Scotland Hydro-Electric Board was laid before Parliament last week, having been confirmed by the Secretary of State for Scotland. It is planned to build one barrage, two dams, thirteen aqueducts or lines of pipes, and three generating stations with a total installed capacity of some 450 MW. The estimated cost is £24·5 million. The scheme is designed to meet the growing load in the North of Scotland and, in addition, to provide from its pumped storage section peak load supplies for the South of Scotland.

The project consists of three inter-dependent sections—Nant, Cruachan and Inverawe. The Cruachan section has been prepared after consultation with the South of Scotland Electricity Board and will include the first large-scale pumped storage works in Scotland. The pumped storage section is designed to use surplus energy from power stations in the South of Scotland at off-peak times to pump water to a high-level reservoir.

The level of Loch Nant will be raised by a dam at its outlet and water from the Loch will be led by tunnel and pipelines to feed a generating station on the shore of Loch Awe, near Inverinan. This station will have a capacity of about 18 MW and an annual estimated output of 27 million kWh.

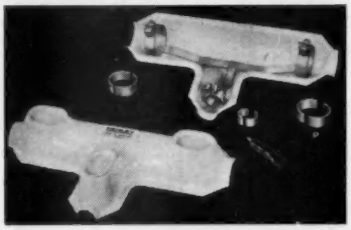
A combined pumping and generating station built underground near the shore of Loch Awe will pump water from Loch Awe to a reservoir to be formed in a corrie of Ben Cruachan at a height of about 1,300ft. The catchment area of this reservoir will be extended by aqueducts collecting water from the headwaters of the Rivers Liever and Noe. Water will be drawn from the reservoir to operate the generating plant in the underground power station, which, to serve the two purposes of conventional and pumped storage operations, will have an installed capacity of about 400 MW.

The level of Loch Awe will be regulated by a low barrage on the River Awe. From the barrage water will be taken through a tunnel to a power station situated near Inverawe, just within the mouth of the river. This station will have an installed capacity of some 30 MW and an average annual output of 100 million kWh. Provision is made by the barrage for the release of compensation water into the River Awe, and for the construction of a fish pass.

NEW ELECTRICAL EQUIPMENT

Plastic Joint Boxes

Following the introduction of p.v.c. insulated wire armoured cables for low and medium voltage distribution systems, W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 51-53, Hatton Garden, London, E.C.1, have designed a range of joint boxes manufactured



Henley plastic service box

from p.v.c., comprising straight through, service and branch boxes for cables up to 0·30 sq in.

The boxes are moulded from p.v.c. sheet in two halves which are assembled with adhesive when the jointing has been done to form a complete shell. The top half is provided with compound filling holes with press-in covers. Copper bonds with combined clamping rings which securely grip the armouring wires are supplied to ensure continuity of the armouring. Henley cold filling compound is used, and this adheres to both the p.v.c. insulated cores and the box.

Cable Tester

An instrument for the high-speed detection of cable insulation faults during manufacture has been developed and put into production by TYER & CO., LTD., successor to P.A.M., Ltd., in the Southern Areas Electric Corporation. Known as the "Perram" cable tester, indicator and recorder, it offers a non-destructive method of assessing the quality of the insulation of cables, which can be graded accordingly. The instrument comprises a non-lethal generator, with a continuously adjustable output between 4 and 20 kV d.c., a high-speed electromagnetic counter, an alarm indicator employing a lamp and bell, and an automatic overload protection circuit.

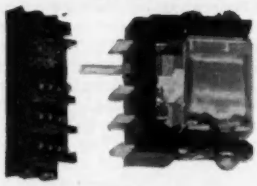
The output is applied to a small ring

Tyer "Perram" cable tester

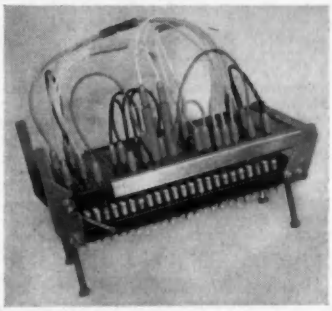
electrode used for examining the cable insulation; when a fault or break in the insulation is detected the resulting voltage discharge is registered by the counter and the alarm system operates for a minimum period of four seconds, giving visible and audible warning. A close succession of faults will be recorded on the counter and, if a sustained fault occurs, an automatic overload protection circuit switches off the generator, keeping the alarm indicators working until the instrument is manually reset.

Relays, Torque Motors and Patchboard

New items recently announced by the WODEN TRANSFORMER CO., LTD., of Moxley Road, Bilston, Staffs., and their associated company, T. S. Precision Engineering, Ltd., include a high-speed, multi-pole wire contact plug-in relay which is suitable for use in individual or multi-holders which can be soldered directly or used with a quick release plug. The basic unit is a 4-pole change-over relay with twin



The Woden-T.S.P. wire contact relay and (below) patchboard

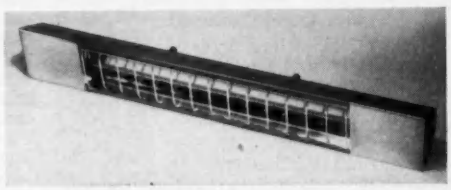


wire contacts which are readily interchangeable. The unit and all fixed contacts are in a single-piece moulding and the contacts are of silver alloy. High-speed working is obtainable with operating and release times down to 3 millisec and the unit has an expected contact life of three million operations. Coils having resistances from 100 to 10,000 ohms and operating voltages from 6 to 150 V d.c. are available.

Other introductions are a range of torque motors having ±7 deg angular movement and a patchboard of standard dimensions, 7in by 4in with 334 sockets at ¼in pitch. Each individual self-aligning spring-loaded contact has a positive lock and the contact pressure is 12-14 oz. The maximum continuous current rating of each contact is 1 A giving a 10 millivolt drop. Patch cords from 6 to 24in long, each fitted with a moulded barrel plug covered in p.v.c. in a variety of colours, are available.

Industrial Infra-Red Heater

A neat, robustly constructed infra-red heating unit, designed for industrial use, has just been placed on the market by USEEKIA, 67, Goldhawk Road, London, W.12. Known as the U-R-E infra-red heater, it has a 750 W nichrome spiral element, totally enclosed in a silica tube, protected by a curved chromium plated guard. The reflector has a highly polished surface, which greatly reduces the warming-up period. The body of the heater is constructed of a heavy gauge steel, fully pre-treated and stove enamelled, while the finish of the end covers is



Useekia U-R-E infra-red heater

satin chrome on a copper/dull nickel base.

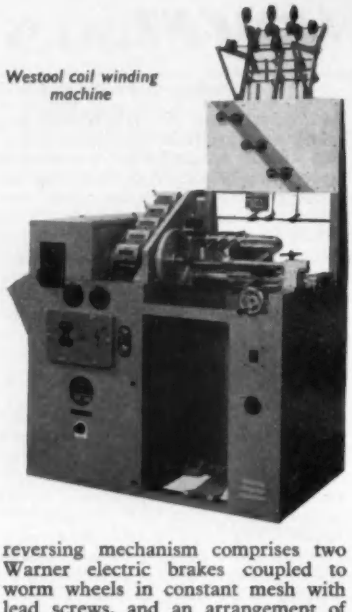
The heater may be mounted on a wall, or suspended from a ceiling, and two drilled lugs to facilitate mounting are provided on the back cover. There is also a hole for conduit entry and the removal of one screw permits easy access to the wiring terminals.

The overall length of the infra-red heater is approximately 30in and the price is £3 15s.

Coil Winding Machine

A coil winding machine manufactured by WESTOOL, LTD., St. Helen's Auckland, Co. Durham, is capable of simultaneously winding three coils up to 9in in diameter and up to 4in in width, using wires from 14 to 42 s.w.g. Four speed ranges are provided, 0/350, 0/750, 0/1,500 and 0/2,000 r.p.m., and a foot pedal controls the rate of acceleration from zero to maximum on any range.

The machine may be provided with up to five predetermining revolution counters and may also be fitted with an "end of layer" stopping device to facilitate hand interleaving. The



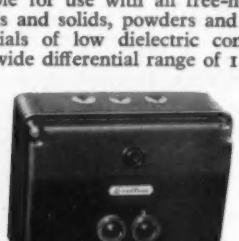
Westool coil winding machine

reversing mechanism comprises two Warner electric brakes coupled to worm wheels in constant mesh with lead screws, and an arrangement of adjustable stops and microswitches gives positive and instantaneous reversal of direction.

Remote Level Controller

A remote level indicator and controller, the "Leveltron," which can operate at distances up to 60 yd from the detection point has been introduced by THOMAS INDUSTRIAL AUTOMATION, LTD., Station Buildings, Altrincham, Cheshire.

Operating on the electrical capacitance principle whereby the change in capacitance at an electrode on the approach or recession of a material actuates a control relay, the unit is suitable for use with all free-flowing liquids and solids, powders and other materials of low dielectric constant. The wide differential range of 1 to 40



Thomas industrial model remote level controller

pF is adjusted by two controls, the first setting the control point of the relay and the second varying the re-setting point without affecting the control point, so determining the differential required. The relay current is triggered to provide a snap action of the relay and eliminate chatter.

There are three basic instruments: general purpose, industrial and remote control models, each offering a choice of supply of 110, 240 or 440 V a.c. at 40 c/s, and each having two indicator lamps, one pair of normally open relay contacts and one pair of normally closed contacts. A lightweight dust-protected relay is fitted to the general purpose instrument, with a switching capacity on a non-inductive load of 5 A at 250 V a.c., and the industrial model is equipped with a contactor type relay with a switching capacity of 5 A at 440 V a.c. or 10 A at 250 V a.c. The instrument costs between £26 and £46 depending upon the application.

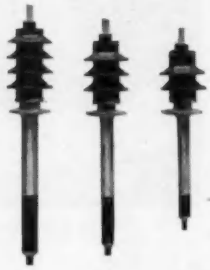
Electrostatic Generator

A range of electrostatic generators developed by the Société Anonyme de Machines Electrostatiques, Grenoble, are being marketed by MILES HIVOLT, LTD., 91, Princedale Road, London, W.11. The high voltage d.c. Felici generator is contained in a hermetically sealed cylindrical pressure vessel. A rotor of insulating material with an inner glass cylinder stator is driven at 3,000 r.p.m. by an induction motor. Electric charges in the form of ions are sprayed on to the rotor at the charging poles and transported to the output poles. These thin blade output poles are placed close to the rotor and commutation takes place without any rubbing contact. The electronic circuits for excitation, voltage control, switching and measurement are contained in a separate cubicle.

The units are suitable for high voltage testing of transmission lines and cables and are said to be more compact than other h.v. generators at a comparable price. The generators are made in various sizes up to 600 kV at 4 mA. A 1,200 kV unit is under development.

Interchangeable Bushings

The range of "Dialam" apparatus bushings, introduced by PERMALI, LTD., Bristol Road, Gloucester, to meet North American (N.E.M.A./C.E.M.A.) specifications, are designed as standard interchangeable oil circuit-breaker and transformer bushings and are supplied for all standard ratings from 8·66 to 69 kV and up to 1,200 A.



Permali bushings

The bushings have no conservator head, and a spring washer assembly reduces the short air length.

The insulating core is manufactured from bakelised paper, giving high thermal stability and low dielectric loss characteristics plus good mechanical strength and resistance to moisture. Thin metallic foils are inserted during the wrapping process to provide conducting layers for controlling both axial and radial stresses.

CATALOGUES AND LISTS

ALARM SYSTEMS.—Brochure dealing with the "Auto-Thermatic" system of automatic and manual fire warning and a folder giving particulars of the range of equipment including intercommunication apparatus produced by the company.—**Sound Diffusion (Auto-Thermatic), Ltd.,** 243/247, Coastal Chambers, Buckingham Palace Road, London, S.W.1.

BOBBINS.—Drawing giving particulars of a range of round and square coil formers and bobbins for the production of which the company has moulds.—**Frederick W. Evans, Ltd.,** Plastic Works, Long Acre, Birmingham, 7.

BRAKES.—Brochure describing the company's electro-mechanical brakes and showing typical examples of equipment fitted with these brakes.—**Lancashire Dynamo & Crypto, Ltd.,** St. Stephen's House, Victoria Embankment, Westminster, London, S.W.1.

BUSHES. — 8-page booklet giving particulars of rubber and moulded conduit bushes, rubber cable connectors, grommets, washers and other accessories.—**Metway Electrical Industries, Ltd.,** Canning Street, Brighton, 7.

CATHODIC PROTECTION. — Leaflet giving information on the "Economy" range of cathodic protection rectifier equipments.—**Standard Telephones & Cables, Ltd.,** Edinburgh Way, Harlow, Essex.

LIGHTING FITTINGS.—20-page illustrated catalogue (A.F.210) and separate price list covering the "Fiesta" range of contemporary style lighting fittings.—**A.E.I. Lamp & Lighting Co., Ltd.,** Melton Road, Leicester.

25-page illustrated catalogue describing the company's lighting advisory service and giving particulars and prices of pendant, cornice and modular fluorescent lighting fittings, etc.—**Ekco-Ensign Electric, Ltd.,** 45, Essex Street, London, W.C.2.

MINING EQUIPMENT. — Four leaflets giving particulars of items of colliery equipment manufactured by the company.—**Westinghouse Brake & Signal Co., Ltd.,** 82, York Way, King's Cross, London, N.1.

SILICONE RUBBER.—16-page illustrated booklet dealing with "Silastomer" silicone rubber and showing typical examples of its uses in the electrical and other industries.—**Midland Silicones, Ltd.,** 68, Knightsbridge, London, S.W.1.

SWITCHGEAR. — Illustrated brochure giving particulars and illustrations of typical products of the company.—**Astral Switchgear, Ltd.,** Alma Road, Enfield, Middlesex.

VALVES.—40-page catalogue (OV.4585) giving details in tabular form of the company's range of industrial valves and cathode ray tubes.—**The M-O Valve Co., Ltd.,** Brook Green, Hammersmith, London, W.6.

VEHICLE DETECTOR. — Illustrated leaflet giving particulars of the type FS "Electro-matic" vehicle detector.—**Automatic Telephone & Electric Co., Ltd.,** Strowger House, Arundel Street, W.C.2.

WATER HEATERS.—Series of leaflets dealing with the range of thermal storage water heaters and immersion heaters produced by the company.—**A.E.I.-Hotpoint, Ltd.,** 33, Grosvenor Place, London, S.W.1.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets completed the first quarter of 1959 in reasonably good style, with Government securities steady and the average of industrial share prices not very much below the record levels established at the turn of the year. Optimism with regard to the Budget has become apparent, although held in check by contemplation of the General Election bulking increasingly large behind it. In the industrial market the rising popularity of shares in the consumer goods industries has been a feature, reflected in the electrical sections by considerable activity in issues concerned with domestic equipment.

Investments in the heavier branches of electrical engineering have been relatively stable but have remained well supported. The following table illustrates the rather mixed experiences of shares in a variety of the industry's branches over the first three months of the year:—

Ordinary Shares	Price		Change
	Jan.	Mar.	
A.E.I.	57/6	55/–	–2/6
Auto. Tel. & Elec.	80/–	77/6	–2/6
Brook Motors	45/6	54/–	+8/6
Chloride Electrical	70/–	73/6	+3/6
Crompton Parkinson	13/9	13/–	–9d
English Electric	61/6	64/–x.r.	+2/6
G.E.C.	40/–	31/9	–8/3
Internl. Combustion	31/3	34/9	+3/6
Lancs. Dynamo	45/6	47/3	+1/9
C. A. Parsons	55/–	51/–	–4/–
Plessey	72/6	74/9	+2/3
Reyrolle	97/6	94/6	–3/–
Ward & Goldstone	36/6	37/6	+1/–
Allen West	13/6	13/9	+3d
Westinghouse	46/3	42/6	–3/9

Cables and Others

The cable manufacturing section of the market was thinned out during the past quarter by the termination of normal dealings in the shares of T. C. & M., W. T. Henley's and London Electric Wire, following the absorption of these companies into larger groups. These events excited a good deal of interest in the remaining issues, resulting in fairly large activity and price fluctuations at times. Some domestic equipment shares have recently lost a part of earlier rises, but this has remained a very popular sphere of investment. Among radio and electronic shares, E.M.I. have been the principal centre of activity. Price changes in these various sections are illustrated in the table.

Ordinary Shares	Price		Change
	Jan.	Mar.	
Aberdare	15/9	16/–	+3d
B.I.C.C.	52/–	48/6	–3/6
Enfield	16/3	19/–	+2/9
J. & P.	25/6	23/–	–2/6
Scottish Cable	12/9	14/3	+1/6
Brit. Vac. Cleaner	4/9	7/–	+2/3
Hoover	60/–	61/3	+1/3
Morphy-Richards	20/–	21/–	+1/–
Vactric	33/6	37/3x.c.	+3/9
E. K. Cole	18/–	18/9	+9d
Decca "A"	37/–	34/9	–2/3
E.M.I.	54/6	58/–	+3/6
Philips Lamps	93/–	102/6	+9/6
Elliott-Automation	17/9	19/–	+1/3
Pye	15/–	15/6	+6d
Thorn Elec.	28/–	33/6	+5/6

April Dividends

News of dividend declarations and company results normally approaches the flood marks during April. Assuming that the timing is about the same as it was last year, one of the first announcements of the month will come from A. Reyrolle, followed within a week or two by those of C. A. Parsons, Simon-Carves and Babcock & Wilcox, all closely concerned with nuclear power development. A main event will be the publication of the B.I.C.C. results, due about the middle of the month, at which time announcements may be expected also from Automatic Telephone, Lancashire Dynamo, Laurence Scott, Allen West, Chloride Electrical and Newman Industries. News from Enfield Cable is due about now.

Increased Dividends

A. F. Bulgin's decision to raise the dividend for 1958-59 from 45 to 50 per cent gives shareholders an improvement in their return for the fifth year in succession, and the extra amount is accommodated comfortably by a further rise of more than 20 per cent in the net profit to £88,000 after tax. Subsequently the 1s shares were marked up sharply to 8s 9d, at which level they offer a yield of 5¼ per cent. A larger dividend and record profits are reported also by A. H. Hunt (Capacitors). At £126,000, the net surplus after tax is some £37,000 to the good and covers fully three times over the amount of the ordinary dividend, which is being made up to a total of 15 per cent, against 13¾ per cent for the previous year. The yield on the 4s shares at 11s is nearly 5½ per cent. Bulpitts (Swan Brand) 5s shares rose well to 12s 6d on the declaration of a final dividend making a total of 15 per cent, which is 2½ per cent more than the rate indicated when the shares were publicly offered for sale at 7s a year ago.

Rediffusion Issue

Dealings have been taking place recently in the new Rediffusion 5s shares at a premium of about 4s on the price of 29s at which 2·86 million shares were offered by way of rights to existing holders. They are at present 15s paid-up, with the balance of 14s not due until September. Proceeds of this issue, amounting to more than £4 million, are needed mainly to finance the fast growing development of the wired television services. While the shares have long been popular (formerly under the name of Broadcast Relay Service) as an investment in that field, public interest in them has considerably expanded since the company acquired its stake in commercial television.

Dividend Prospects

The Rediffusion company's interest in commercial television is represented mainly by a 37½ per cent interest in Associated-Rediffusion (the contractors for the London mid-week programmes), of which half the capital is held by British Electric Traction. Recently the television company has published an estimate that its profits in the current year will be not less than £7 million, or about £2 million more than in the previous twelve months. For last year Rediffusion paid dividends equivalent to 12½ per cent net. Anticipating an appreciable improvement in the figures for 1958-59, the directors indicate a total distribution of 15 per cent net on the older capital. Assuming the maintenance of this rate on capital increased by the new issue, there is a prospective yield of approximately 4 per cent on the new shares at an all-in price of 33s.

Amalgamations

The announcement of the amalgamation agreement between Taylor Tunnicliff Electrical Industries and Bullers, Ltd., produced favourable initial reactions from both the shares concerned, the former's 5s ordinary rising further to 26s (but easing later to 23s 6d) and Bullers 10s shares to 43s. A holding company is to be formed and shareholders are promised the details as soon as possible. The offer made on behalf of Pye to buy the issued share capital of Lindley Thompson Transformer & Service, for prices of 2s 6d for each 1s ordinary and 16s for each preference share, has been accepted to the extent of over 90 per cent of both classes of capital and remains open. A statement from Pye, who are financing the transaction by issuing a sufficient number of ordinary shares at 13s each, explained that this action marked the entry of the company into the manufacture of heavy electrical equipment and would widen the scope of the group's activities.

Owing to the Easter holiday our usual table, "Price Changes in Electrical Investments," is omitted. It will appear again in next week's issue.

Quality in Industry

A conference organised jointly by the Institution of Production Engineers, the Institution of Engineering Inspection and the British Productivity Council on "Quality Control" will be held on 18th and 19th June next at the Palace Hotel, Buxton. Particulars and application forms can be obtained from the Conference Secretary, Institution of Production Engineers, 10, Chesterfield Street, Mayfair, London, W.1.

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd.—The main figures in the accounts for 1958 were given in a preliminary statement published in our issue of 13th March. In the full report and accounts now issued, the directors state that the value of goods dispatched from the factories of the A.E.I. Group in 1958 was £181½ million, an increase of 21¼ per cent on the previous year, and a substantial part of the total output was exported. Orders received during 1958 by all A.E.I. Group companies, both home and overseas, amounted to £168 million (against £177 million). At the end of the year there were orders in hand to the value of £182 million, as compared with £180 million at the end of 1957. The 1958 figures of orders received and orders in hand include those of subsidiary companies purchased during the year. During the year the company issued £25 million 6 per cent debenture stock 1978-83 (secured), part of which was issued as repayment of the 3½ per cent ten-year notes, 1954-59. Reference is made in the report to the formation of a number of new subsidiary companies during the year and to acquisitions, including the share capital of W. T. Henley's Telegraph Works Co., Ltd. An offer was also made in December last for the issued capital of the London Electric Wire Co. & Smiths, Ltd.

Clarke, Chapman & Co., Ltd.—In the course of his speech at the annual meeting held on 20th March, Mr. J. B. Woodeson (chairman) said that although the results for 1958 showed a fall in earnings they reflected a further step in the return to more normal trading conditions. The peak results that came about in the previous years were due to long-term boiler contracts occasioned by the post-war programme of the Central Electricity Authority in its urgent demand for power. Taking into account current trading conditions, the period under review had resulted in a satisfactory profit. The past year had been a busy one in the departments producing ships' deck machinery. There had been a further move away from steam to electric drive with consequent repercussions in the works. The marine orders to be executed in 1959 would ensure that the works were kept nearly at full capacity, and this state of affairs would continue into early 1960.

In common with other manufacturers of water-tube boiler plant they were passing through a difficult phase. Demand for power station plant occasioned by the giant post-war programme of the C.E.A. created unusual conditions in the industry. Existing manufacturers were asked to increase their capacity and other manufacturers were encouraged to enter the field. The efficiency and availability of power producing plant had increased and modern designs had resulted in the units being larger. This had resulted in the placing of fewer contracts. It was against this background that they had been pressing forward with their development work for boiler plant associated with nuclear energy. As members of the Nuclear Power Plant Co., Ltd., an order had been obtained, and they were manufacturing a large section of the heat exchanger plant for Latina, Italy. Their initial experience in the nuclear field was encouraging. It would be some time before they could be sure of their trading returns in this field, but over the long term they should be fully repaid for their interest in this direction. In the current year they would obtain the full benefit of the research workshop completed in 1958. A physics laboratory approached completion and they hoped shortly to provide proper facilities for all their research activities.

Bylock Electric, Ltd.—The annual meeting was held on 24th March, Mr. C. A. Mathes (chairman) presiding. In his circulated statement, the chairman said the company was engaged in the development of various additional lines and during the year under review had produced and started selling the new "Headmaster" fan heater. Further developments were in an experimental stage and, in due course, would be put on the market. The directors had entered into negotiation for the acquisition of a further factory, but it was unlikely that production would commence there before the autumn of this year.

Speaking at the meeting, Mr. Mathes said that since his statement had been issued they had acquired the new factory, which was at Waltham Abbey. The company's turnover for the first half of the year was a record, but by reason of the credit squeeze and other factors fell away a little in the second half. They had recovered since the end of the financial year and turnover to date was slightly higher than for the same period last year.

Sangamo Weston, Ltd., reports a trading profit for 1958 of £382,235, as compared with £398,685 for 1957. Taxation absorbs £141,781 and the net profit is £135,526 (against £167,328). It is proposed to maintain the dividend for the year at 12½ per cent and to make a one-for-three scrip issue. The balance carried forward is £139,693 (against £302,358 brought in).

The Telephone & General Trust, Ltd., reports that after meeting all charges, including £216,404 for taxation, the group profit for 1958 is £422,458, as compared with £399,522 for 1957, of which £286,009 is attributable to the holding company. General reserve receives £50,000. It is proposed to pay a final dividend of 9 per cent (against 8 per cent) on the ordinary shares, making 14 per cent (13 per cent) for the year, and also to pay 14 per cent (13 per cent) for the year on the "A" ordinary capital. The balance carried forward is £197,950 (against £188,582 brought in).

A. F. Bulgin & Co., Ltd.—After providing £99,036 for taxation, the net profit for the year ended 31st January last was £88,115, as compared with £72,522 for the preceding year. General reserve receives £10,000 and a sum of £20,000 is placed to dividend equalisation reserve. It is proposed to pay a dividend for the year of 50 per cent (against 45 per cent).

Metal Industries' Avo Offer.—Metal Industries, Ltd., which recently made an offer for the 2,500,000 shares in Avo, Ltd., announces that Singer & Friedlander, Ltd., acting on its behalf, have received acceptances in respect of more than 90 per cent of Avo's capital, and the offer has accordingly become unconditional.

The closing date for acceptances was postponed until 31st March, after which date steps will be taken to acquire any outstanding shares under Section 209 of the Companies Act, 1948. Those who accepted the offer by 31st March will have the option of receiving one new Metal Industries ordinary share of £1 for every four shares held in Avo instead of the cash offer of 10s per Avo share. After that date, Avo shares will be acquired only for cash at 10s per share.

Relay Exchanges, Ltd.—An extraordinary meeting will be held on 15th April at which a resolution will be submitted authorising an increase in the capital to £3,000,000 by the creation of 3,000,000 ordinary shares of 5s each ranking *pari passu* as one class of shares with the existing ordinary shares.

In a circular to shareholders, the board states that the need for additional capital has considerably increased following the abolition of the restrictions of the Control of Hiring Orders, and it has arranged to issue £1,250,000 unsecured loan stock 1979-84 carrying interest at the rate of 6¼ per cent. An issue of 1,746,995 5s shares is also being made to shareholders by way of rights on the basis of one share for every four held at a price of 20s a share.

Wolf Electric Tools (Holdings), Ltd.—The group profit for 1958, after deducting £96,843 for taxation, is £86,003, as compared with £126,741 for 1957. General reserve of the holding company receives £50,000 and the dividend for the year is maintained at 10 per cent. The balance carried forward is £56,920 (against £59,589 brought in).

Sydney S. Bird & Sons, Ltd.—After deducting £69,734 for taxation, the group net profit for the year to 2nd January, 1959, is £72,304, as compared with £121,387 for the previous year. It is proposed to pay a final dividend

of 10 per cent, making 20 per cent for the year. For the previous year the total dividend was 20 per cent and in addition a capital distribution of 5 per cent, tax free, was made.

Desoutter Brothers (Holdings), Ltd.—The main figures in the accounts for 1958 were given in our issue of 13th March. In his statement, which accompanies the report and accounts now issued, Mr. G. H. Webb (chairman and managing director) says that group sales in all departments on the home market show a small increase over the previous year. The export market became increasingly difficult as the year progressed and, with currency restrictions and greater competition for reduced orders, sales showed some reduction. The total overall sales of the group were slightly higher than that achieved in 1957. The process of reorganising the productive departments of the principal subsidiary continued throughout the year, and where necessary new and more up-to-date plant was installed. Outstanding orders on the whole are a little lower than twelve months ago, but this is not viewed with apprehension, as this is a natural reaction following the policy of effecting deliveries from stock.

Philips Electrical, Ltd., has bought for cash the control of Cossor Radio & Television, Ltd., a subsidiary of A. C. Cossor, Ltd. This confers on Philips the right to use Cossor trade marks on television and radio sets and on sound reproducing equipment for domestic use in all countries of the world except Canada and Pakistan. Philips do not intend to alter the existing trade distribution arrangements for Cossor sets. Manufacture of sets by Cossor will cease. The Philips factory at Croydon will probably eventually take over the production of sets under the Cossor label.

Charles Clifford, Ltd., report a consolidated trading profit for 1958 of £148,865, as compared with £114,139 for 1957, to which is added income from tax reserve certificates, bank deposits and short-term loans of £14,123, making £162,988. Taxation absorbs £86,822 and the net profit is £76,166 (against £51,121). Stock reserve receives £22,500 and general reserve £20,000, and it is proposed to pay a final ordinary dividend of 7 per cent, maintaining the distribution for the year at 10 per cent. The balance carried forward is £97,674 (against £97,473 brought in). In his statement which accompanies the report and accounts, Mr. E. A. Norton (chairman) says that trade has not been bright during the year and competition has greatly increased; the management are to be congratulated on the results they have achieved. At their main works at Dog Pool they have completed the capital expenditure programme on the new rod mill, which is now in operation, and they are continuing with their programme of modernisation in order to maintain their competitive position. The subsidiary companies have again contributed substantially to the profits of the group. Continuing their programme of widening their field in metal spraying, they have opened a new works at Stockton-on-Tees. In the latter part of last year, by the purchase of a controlling interest in Metal Sprayers, Ltd., London, they have secured that their metal-spraying services will be fully available in the Home Counties.

Watford Electric & Manufacturing Co., Ltd.—The net profit for the past year was £89,496 as compared with £74,121 for the preceding year. A final dividend of 10 per cent and a bonus of the same amount are being paid. This makes a total of 25 per cent, as last year, but the capital has since been increased by a one-for-four capitalisation issue.

Elliott-Automation, Ltd., has formed a subsidiary, the Swartwout Co., to make and sell the electronic control systems developed by the Swartwout Company of Cleveland, Ohio. These include equipment for process industries, heating and ventilating, and for power stations, "conventional" and nuclear.

Bulpitt (Swan Brand), Ltd., which was made public in March last year, reports a group trading profit for the period 14th March, 1958, to 31st December last of £688,806. Taxation absorbs £411,455 and it is proposed to pay a final dividend of 10 per cent, making 15 per cent for the period.

The Nigerian Electricity Supply Corporation, Ltd., has declared an interim dividend of 3 per cent (against 4 per cent).

New Companies

D. J. Badman & Co., Ltd.—Registered 5th March. Capital £4,000. Manufacturers and repairers of and dealers in dynamos, armatures, magnetos, etc. Directors: D. J. Badman and Mrs. Dorothy E. F. Badman. Regd. office: 21, Stone Street, Gravesend, Kent.

Bresslaw & Davies, Ltd.—Registered 5th March. Capital £100. Electrical engineers and general electrical installation contractors, lighting specialists, radio and television engineers, etc. Directors: A. S. Bresslaw and W. Davies. Regd. office: 113, High Holborn, W.C.1.

Elvac Controls, Ltd.—Registered 6th March. Capital £100. Manufacturers of and dealers in electronic and vacuum low temperature and laboratory instruments and controls, electrical and electronic and refrigerating apparatus, etc. Directors: P. Stein and Agnes B. Stein. Regd. office: Lower Elford Town Farm, Yelverton, Devon.

Vanner & Coster, Ltd.—Registered 6th March. Capital £100. Electrical engineers, etc. Directors: G. Vanner and R. Coster. Regd. office: 62, Nelson Street, E.1.

Vox Appliances (U.K.), Ltd.—Registered 6th March. Capital £15,000. Manufacturers of and dealers in electrical domestic appliances of all kinds, etc. Directors: N. I. J. Hougardy and R. A. G. J. Bettens. Regd. office: 20, Eastcheap, E.C.3.

Bell & Palmer, Ltd.—Registered 10th March. Capital £2. Manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: Norah M. Palmer and Doris I. Bell. Regd. office: 174, High Street, Hounslow, Middx.

Jacques (Electrical), Ltd.—Registered 9th March. Capital £500. Electrical engineers, designers, machinists, etc. Directors: L. Jacques and Mrs. Joyce E. Jacques. Regd. office: 134, Moston Lane, Moston, Manchester.

Lamberts (Farnham Road), Ltd.—Registered 23rd February. Capital £100. Manufacturers, wholesalers, retailers, importers, exporters of electrical equipment, etc. Directors: F. G. Lambert, Megan L. Lambert and H. C. Thomson. Regd. office: 48, Market Place, Reading.

Cable Markers (Sales), Ltd.—Registered 23rd February. Capital £1,000. Manufacturers of and dealers in electrical apparatus, fittings, accessories, appliances, requisites and equipment of all kinds, etc. Directors: A. Stephens and S. J. Snelling. Regd. office: 107, Gales Drive, Three Bridges, Sussex.

H. & S. Electrics, Ltd.—Registered 20th February. Capital £5,000. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: J. R. Holbrook and G. K. Sullivan. Regd. office: 6a, Caerleon Road, Newport, Mon.

L. E. Harris & Co. (Fleet), Ltd.—Registered 9th March. Capital £1,000. Electrical equipment specialists, etc. Directors: N. C. Marks and L. E. Harris. Regd. office: 210, Fleet Road, Fleet, Hants.

Swartwout Co., Ltd.—Registered 9th March. Capital £100. To manufacture, assemble, repair and deal in control systems and articles in connection with the control, operation and indication by electronic, electrical, mechanical, pneumatic and other means of manufacturing processes, etc. Directors: G. C. Fairbanks and M. V. Needham (directors of Elliott Nucleonics, Ltd.). Regd. office: Century Works, Lewisham, S.E.13.

J. Clifford Jones, Ltd.—Registered 9th March. Capital £1,000. Electrical and electronic engineers and contractors, etc. Directors: J. C. Jones and Zola E. M. Jones. Regd. office: 77, London Road, Leicester.

Broadwick Electrical & Cinema Co., Ltd.—Registered 20th February. Capital £100. Manufacturers, producers, importers and exporters of and dealers in electrical and radio and television plant; acoustic, cinematographic and all other kinds of sound producing and photographic machinery and equipment, etc. Solicitors: Richards, Butler & Co., 11, Waterloo Place, S.W.1.

B.M.P. Radio & Television Services, Ltd.—Registered 24th February. Capital £100. Radio, television and electrical retailers and engineers, etc. Directors: I. A. B. Brampton, R. H. Michie and C. A. Pearson. Regd. office: 9, Windsor Street, Chertsey.

Jaco Products (Electrical), Ltd.—Registered 20th February. Capital £100. Electronic and electrical engineers, etc. Directors: G. Middleton and W. V. H. Watts. Regd. office: 2, Church Road, Stanmore, Middx.

Wholesale Electrical Supplies (Enfield), Ltd.—Registered 20th February. Capital £100. Directors: L. F. Wilson and Mrs. May Wilson. Regd. office: 78, Dean Street, Soho Square, W.1.

Butterworth Electrical Sales, Ltd.—Registered 25th February. Capital £100. Dealers in, repairers, installers and maintainers of electrical appliances and equipment, including radio and television sets, etc. Directors: G. Butterworth, P. Butterworth and J. R. Beal. Regd. office: 101, Park Grove, Hull.

Cleveland Rewinds, Ltd.—Registered 25th February. Capital £1,000. Electrical equipment specialists, manufacturers and rewinders, coil winders and manufacturers of electrical rotary machinery, etc. Directors: R. S. Fairfax and Mary J. Surtees. Solicitors: Stanley N. Walton, Darlington.

Bankruptcies

J. V. Barke, 21, Circular Drive, Chester, electrical engineer.—Trustee, Mr. S. O. Henry, of Parkin S. Booth & Co., 5, Rumford Place, Liverpool, 3, released 11th March.

A. M. Henry, 10, Woodgrange Avenue, Ealing Common, London, W.5, electrical heating engineer.—Trustee, Mr. W. Whitehead, 58-61, York Terrace, Regents Park, London, N.W.1, Official Receiver, released 18th March.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

1433. Siemens Edison Swan, Ltd.—Automatic exchange systems. 15th July, 1955. (811107.)

12213. English Electric Co., Ltd.—Electric switchgear with tripping means. 22nd July, 1955. (811142.)

18475. General Electric Co., Ltd., and Brown, C. S.—Method of testing a sample of quartzite for use as source material in a hydrothermal quartz crystal growing process. 23rd June, 1955. (811213.)

18476. General Electric Co., Ltd., Brown, C. S., and Kell, R. C.—Method of growing quartz crystals. 23rd June, 1955. (811214.) 18477. Production of quartz crystals. 23rd June, 1955. (811215.)

20064. S.I.R.E.L.E.C.—Amplifier for direct currents or for very low frequency currents. 11th July, 1955. (811167.)

20883. Vogt, H.—Sealed alkaline electric accumulator. 19th July, 1955. (811306.)

20906. Skillman & Co., Pty., Ltd., T. S.—Multi-channel carrier signalling. 19th July, 1955. (811307.)

20967. Ekman, O. I. H.—Electric fire alarm systems. 20th July, 1955. (811169.)

21126. M-O Valve Co., Ltd.—Travelling wave velocity modulation devices. 13th July, 1956. (811116.)

21702. Lenger, V. J.—Electro-precipitator. 27th July, 1955. (811171.)

21369. Electric & Musical Industries, Ltd.—Telecine apparatus. 22nd July, 1955. (811293.)

22402. Electric & Musical Industries, Ltd.—Electron discharge devices. 7th July, 1955. (811143.)

22713. Electric & Musical Industries, Ltd.—Modulating circuits. 26th July, 1955. (811294.)

24630. Photo Printed Circuits, Ltd.—Electric capacitors. 23rd August, 1955. (811295.)

37733/4. United Kingdom Atomic Energy Authority.—Welding apparatus. 31st December, 1955. (811216/7.)

37791. English Electric Co., Ltd.—Thermionic valve circuits. 30th December, 1955. (811144.)

1955

294. Burndept, Ltd.—Methods of manufacturing electrical condensers. 5th January, 1956. (811106.)

8946. National Research Development Corporation.—High frequency transformers. 22nd May, 1956. (811351.) 8947. Isolating transformers. 13th June, 1956. (811352.)

16557. United Kingdom Atomic Energy Authority.—Apparatus for cyclically monitoring potentials at a number of stations. 31st May, 1956. (Cognate application 25579, 7th September, 1955.) (811111.)

18724. British Dielectric Research, Ltd.—Electric capacitors and their manufacture. 27th June, 1956. (811166.)

18838. General Electric Co.—Dual temperature refrigeration systems. 29th June, 1955. (811114.)

19626. Ericsson Telephones, Ltd.—Means for testing the insulation of electrical conductors. 11th May, 1956. (811303.)

23201. Engelhard Industries, Inc.—Electrical discharge lamp assemblies. 11th August, 1955. (811172.)

25854. Soc. Gramme.—Electrical systems for alternators. 9th September, 1955. (811174.)

26074. British Telecommunications Research, Ltd.—Electrical switching devices. 12th September, 1956. (811314.)

29216. Falk, Stadelmann & Co., Ltd.—Electric lighting fittings, more particularly those for downward beam illumination. 14th January, 1957. (811148.)

29345. Bartenstein, R. E.—Device for reducing the ability of high voltage lines for interfering with wireless or wired transmission systems. 14th October, 1955. (811316.)

30138. Sparcatron, Ltd.—Electromechanical high speed operating mechanism. 15th November, 1956. (811175.)

30660. General Electric Co., Ltd.—Rotary floor cleaning or polishing apparatus. 26th October, 1956. (811317.)

36153. Standard Telephones & Cables, Ltd.—Telephone exchange systems and apparatus. 16th December, 1955. (811151.)

1956

448. Evershed & Vignoles, Ltd.—Electrical digital analogue interconversion circuits. 21st December, 1956. (811325.)

2284. Standard Telephones & Cables, Ltd.—Electric switch connection arrangement. 24th January, 1956. (811327.)

2915. Philips Electrical Industries, Ltd.—Systems for radio communication between a fixed main station and mobile substations. 30th January, 1956. (811224.)

4999. Standard Telephones & Cables, Ltd.—Electrolytic condenser. 17th February, 1956. (811331.)

5330. Telephone Manufacturing Co., Ltd.—Electrical capacitors. 19th February, 1957. (811332.)

5366. General Electric Co., Ltd.—Tap-changing apparatus. 21st February, 1957. (811226.)

7282. Westinghouse Brake & Signal Co., Ltd., and Norton, D. J.—Electromagnetic relays. 8th March, 1957. (811367.)

10694. Automatic Telephone & Electric Co., Ltd.—Protector arrangements for power distribution apparatus. 7th April, 1956. (811337.)

16485. General Electric Co., Ltd.—Electric oscillators. 27th May, 1957. (811372.)

16519. Volex Electrical Products, Ltd.—Panel mountings. 1st August, 1957. (811228.)

19220/1. Belling & Lee, Ltd.—Electric cable end connectors. 17th May, 1957. (811358/9.)

20047. Kummler & Matter A.G.—Conductor wire systems for electric railways. 28th June, 1956. (811230.)

21236. Kanthal AB.—Electric resistance heating elements. 9th July, 1956. (811375.)

21990. Atomic Energy of Canada, Ltd.—Device for monitoring the proton resonance in a liquid. 16th July, 1956. (811232.)

23795. V.D.M. Spinners, Ltd.—Heat pumps. 2nd October, 1957. (Cognate application 16539, 24th May, 1957.) (811381.)

27321. Westinghouse Electric International Co.—Laminated stators for electric motors. 6th September, 1956. (811183.)

27512. General Electric Co., Ltd.—Lamp standards suitable for street lighting. 3rd September, 1957. (811387.)

28320. Dean, P. P.—Overload protected electric motor drive. 17th September, 1956. (811388.)

28979. Morgan Crucible Co., Ltd.—Impregnated electric current collecting brushes and electric contacts. 21st September, 1956. (811390.)

29662. Proctor Electric Co.—Steam irons. 28th September, 1956. (811363.) 29663. Flat irons. 28th September, 1956. (811364.)

30492. Chempump Corporation.—Electric motor driven pumps. 5th October, 1956. (811392.)

31028. Parsons & Co., Ltd., C. A.—Gas turbine plants. 11th October, 1956. (811393.)

31166. Standard Telephones & Cables, Ltd.—Electric supervisory systems. 11th October, 1957. (811240.)

32087. Pirelli S.p.A.—Non-draining compositions for use in electric cables. 22nd October, 1956. (811133.)

34413. Powers - Samas Accounting Machines, Ltd.—Electric storage and data routing apparatus. 14th October, 1957. (811242.)

39000. Standard Telephones & Cables, Ltd.—Automatic telecommunication exchanges. 21st December, 1956. (811244.)

1957

2186. Siemens-Reiniger-Werke A.G.—Devices for limiting a beam of rays. 21st January, 1957. (811192.)

2313. Parsons & Co., Ltd., C. A.—Nuclear reactors. 27th November, 1957. (811405.)

3986. Bendix Aviation Corporation.—Transceiver for multi-channel radio communication systems. 5th February, 1957. (811249.)

4749. Admiral Corporation.—Neutralising circuits for use in radio receivers. 12th February, 1957. (811274.)

4970. Grace & Co., W. R.—Battery plate separators. 13th February, 1957. (811138.)

6403. Yale & Towne Manufacturing Co.—Control switch mounting for motorised hand truck. 26th February, 1957. (811275.)

7509. Siemens & Halske A.G.—Sockets for electric plug-and-socket connections. 6th March, 1957. (811085.)

8780. Westinghouse Electric International Co.—Electroluminescent cells. 18th March, 1957. (811087.)

16134. Century Lighting, Inc.—Lighting control circuits. 21st May, 1957. (811256.)

18452. Sylvania Electric Products, Inc.—Low pressure fluorescent electric discharge lamp. 11th June, 1957. (811281.)

18519. Westinghouse Electric International Co.—Bi-stable trigger circuits. 12th June, 1957. (811091.)

18533. Philips Electrical Industries, Ltd.—Synchronised oscillators. 12th June, 1957. (811201.)

18863. Autophon A.G.—Telephone substation including transistors. 14th June, 1957. (811413.)

18962. Karlstads Mekaniska Werkstad A.B.—Francis turbine runner and method of making same. 17th June, 1957. (811414.)

20106. Standard Telephones & Cables, Ltd.—Electromagnetic relays. 26th June, 1957. (811262.)

25431. Remix Radiotechnikai V.—Paper dielectric material. 12th August, 1957. (811284.)

25758. Standard Telephones & Cables, Ltd.—Voltage stabilisation equipment. 15th August, 1957. (811418.)

26268. Gony, A. L. J. V.—Electric dry shavers. 20th August, 1957. (811207.)

32583. Standard Telephones & Cables, Ltd.—Stabilised electric transistor oscillators. 18th October, 1957. (811095.)

32759. McGraw-Edison Co.—Alkaline storage battery with negative iron electrode. 21st October, 1957. (811288.)

33172. Consolidated Electrodynamics Corporation.—Digital-to-analogue convertor. 24th October, 1957. (811289.)

34887. Standard Telephones & Cables, Ltd.—Analogue-to-digital translators. 8th November, 1957. (811267.)

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 6th APRIL

Birmingham.—College of Technology, Gosta Green, 6 p.m. I.E.E. South Midland Centre and Supply and Utilisation Group. The Provision of Adequate Electrical Installations in—(a) Multi-Storey Flats and Maisonnettes, by C. A. Belcher; (b) Houses, by C. C. Hyams.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "N.I.C.E.I.C.", by H. F. Smith.

Ilford.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "The Work of the National Inspection Council," by E. J. Sutton.

Leeds.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Quiz" night.

Guildford Hotel. I.E.S. Leeds Centre. Annual general meeting.

Liverpool.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. Annual general meeting, followed by "Artificial Fibres," by Dr. P. T. Standring.

London.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Co-operation between the Electricity and Gas Industries," opened by F. C. Smith.

At the Geological Society, Burlington House, W.1, 5.30 p.m. Association of Engineers. "Sonics," by G. Constantinesco.

Newcastle-on-Tyne.—Rutherford College of Technology, 6.15 p.m. I.E.E. North Eastern Radio and Measurement Group. Annual general meeting and film evening.

County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "The Future Development of the City of Newcastle-upon-Tyne," by P. Parr.

Sheffield.—Royal Victoria Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Inland Waterways," by L. Season.

MONDAY, 6th APRIL to THURSDAY, 9th APRIL

London.—Grosvenor House and Park Lane House. Sixteenth Annual Radio and Electronic Component Show.

TUESDAY, 7th APRIL

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "Recent Advances in Speed-Changing Motors," by Professor G. H. Rawcliffe.

Glasgow.—39, Elmbank Crescent, 6.30 p.m. Institution of Engineers and Shipbuilders in Scotland. Annual general meeting, followed by "Engineering Aspects of 25 kV Overhead A.C. Railway Electrification," by A. Watt.

Hammersmith.—Windsor Castle Hotel, King Street, 7.30 p.m. A.S.E.E. West London Branch. Lecturettes.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "An Electron Trajectory Tracer for use with the Resistance Network Analogue," by M. E. Haine and J. Vine.

A.S.E.E. West Kent Branch, 1.45 p.m. Visit to London Airport.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, Computer Group. Symposium on "Large Capacity Storage Systems."

Manchester.—Engineers' Club, 17, Albert Square, 6.15 p.m. I.E.E. North Western Centre. "H.V. D.C. Transmission, with special reference to the Cross-Channel Cable," by F. J. Lane.

Newcastle-on-Tyne.—Crown Hotel, 7.30 p.m. A.S.E.E. Tyneside Branch. "Education from the Turn of the Century."

Nottingham.—College of Arts and Crafts, 6.30 p.m. I.E.E. East Midland Centre. "Subscriber Trunk Dialling," by D. A. Barron.

Reading.—Electricity Board Demonstration Room, Market Square, 7.15 p.m. A.S.E.E. Reading and District Branch. "The A.S.E.E.", by E. A. Bromfield.

York.—Royal Station Hotel, 7 p.m. I.E.E. North Midland Centre. "The Relation between Picture Size, Viewing Distance and Picture Quality," by L. C. Jesty.

TUESDAY, 7th APRIL to FRIDAY, 17th APRIL

London.—Earls Court. Factory Equipment, Heating, Ventilation and Thermal Insulation Exhibition.

WEDNESDAY, 8th APRIL

Birmingham.—College of Technology, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. Annual general meeting.

Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Electrical Safety," by G. L. Leighton.

Blackburn.—North Western Electricity Board, Jubilee Street, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Thermonuclear Processes with special reference to Zeta," by E. R. Hartill.

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Wanderings with a Colour-film Camera," by A. Spencer.

Eltham.—Eltham Green School, Queenscroft Road, 7.45 p.m. A.S.E.E. South East London Branch. "Efficient Earth Leakage Protection," by J. A. Robbins.

Glasgow.—39, Elmbank Crescent, C.2, 7 p.m. I.E.E. South West Scotland Sub-Centre. "Investigations of Power Follow Current Phenomena using a Synthetic Power Source," by Professor F. M. Bruce and Dr. L. L. Alston.

39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. "Modern Techniques in Water Flow Measurements," by W. H. P. Leslie.

Leicester.—Grand Hotel, 6.30 p.m. Institution of Heating and Ventilating Engineers, East Midland Branch. Annual general meeting and social evening.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "The New Post Office 700-Type Telephone," by F. E. Williams and F. C. Carter, and "The Design of an Automatic Sensitivity Control for a New Subscriber's Telephone Set—The British Post Office 700-Type Telephone," by F. E. Williams and F. A. Wilson.

Tallow Chandlers' Hall, 4, Dowgate Hill, E.C.4, 12.30 for 1 p.m. Electric Light Fittings Association. Annual luncheon.

Newcastle-upon-Tyne.—Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North Eastern Section. "Radio Exploration of the Galaxy," by Dr. J. Baldwin.

Northampton.—Room B16, College of Technology, 7.15 p.m. Northampton and District Electrical Association. "Electricity in a Coalmine."

Portsmouth.—S.E.B. Canteen, Drayton, 6.30 p.m. I.E.E. Southern Centre. Annual general meeting, followed by "Rockets and Satellites," by Dr. R. L. F. Boyd.

THURSDAY, 9th APRIL

Dundee.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "The Use of Steel-Tank Mercury-Arc Invertors for Generating Medium Frequencies for Induction Heating," by D. L. Smart and J. J. L. Weaver.

Dunfermline.—I.E.E. South East Scotland Sub-Centre. District meeting. "Earthing of Low and Medium Voltage Distribution Systems and Equipment," by F. Mather.

Hull.—Yorkshire Electricity Board, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. District meeting. "Electrical Installations of the R.A.E. High Speed Wind Tunnel at Bedford," by P. McKearney, L. S. Drake and E. G. Mallalieu.

Manchester. — Green Room Theatre, Cheapside, off Cross Street, 6 p.m. I.E.S. Manchester Centre. Annual general meeting followed by "Son et Lumière in Great Britain," by H. Hewitt.

Swansea.—S.W.E.B., The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Domestic High Fidelity Reproduction," by J. Moir.

Wimbledon.—Prince of Wales Hotel, 7.45 p.m. A.S.E.E. South West London Branch. "Industrial Use of Isotopes," by N. H. Lowden.

FRIDAY, 10th APRIL

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "The Use of Steel-Tank Mercury-Arc Invertors for Generating Medium Frequencies for Induction Heating," by D. L. Smart and J. J. L. Weaver.

Birmingham.—Regent House, St. Philip's Place, Colmore Row, 7 p.m. Society of Instrument Technology, Midland Section. Annual general meeting followed by film show.

Brighton.—Bedford Hotel, 7 for 7.30 p.m. I.E.E. Southern Centre. Dinner-dance.

Cheltenham.—Rotunda, 7.30 p.m. Society of Instrument Technology, Cheltenham Section. Annual general meeting followed by "Automation Behind the Iron Curtain."

Coventry.—Hotel Leofric. Rugby Engineers' Ball.

Didcot.—Marlborough Club, 7.30 p.m. A.S.E.E. Oxford and District Branch. "Automatic Temperature Control," by J. A. Taylor.

Leeds.—The Refectory, Leeds University, 7.15 p.m. I.E.E. North Midland Centre. Annual dinner-dance.

Powolnys Restaurant. Institution of Heating and Ventilating Engineers, Yorkshire Branch. Ladies' evening.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group. Discussions on "Light, Hearing and Touch," opened by Dr. E. C. Cherry, and "Automatic Recording and Computing of Results in Human Engineering Experiments," opened by H. C. W. Stockbridge.

Dorchester Hotel, W.1. Scientific Instrument Manufacturers' Association. Dinner-dance.

14, Rochester Row, Westminster, S.W.1, 7 p.m. Junior Institution of Engineers. "Radiography and its Application to Arc Welding Joints," by R. F. Wilks.

1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers. James Clayton Lecture. "Canadian Atomic Energy Development in Review and Prospect," by Dr. W. B. Lewis.

St. Albans.—Water End Barn. E.I.B.A. North Metropolitan Branch. Annual dinner-dance.

Weymouth. — South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. "Thermonuclear Reactors," by D. W. Fry.

SATURDAY, 11th APRIL

Chesterfield. — A.S.E.E. Nottingham Branch. Visit to A.E.I. Glass Works.

Leeds.—Griffin Hotel, Boar Lane, 6.30 for 7 p.m. Institution of Production Engineers, East and West Ridings Region. Annual dinner.

London.—I.E.E. London Graduate and Student Section, 2.30 p.m. Visit to s.s. *Orsova*, Tilbury Docks.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Southern Electricity Authority of Queensland, Brisbane. 14th May. 11 kV automatic reclosing outdoor feeder oil circuit-breakers. (E.S.B. 7040/59. Ten/38091.)*

Department of Works, Melbourne. 25th May. 15 MW (or alternatively 20 MW) oil-fired steam power station at Darwin. (E.S.B. 6994/59. Ten/38015.)*

Birmingham.—Corporation. 15th April. Street lighting equipment. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 6th April. Lamp adaptors. (E.S.B. 7462/59. Ten/38132.)*

Dagenham.—Corporation. 24th April. Street lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 16th April. H.v. line taps. (E.S.B. 6921/59/I.C.A. Ten/38058.)*

Hereford.—Corporation. 11th April. Street lighting equipment. (See this issue.)

India.—India Supply Mission. 29th May. 66 kV and 33 kV suspension and tension insulator strings for Andhra Pradesh Electricity Department. (E.S.B. 6758/59. Ten/37991.)*

Mysore Stores Purchase Committee, Bangalore. 15th April. Research and testing equipment. (E.S.B. 6888/59. Ten/38110.)*

Korea.—Government Office of Supply, Seoul. 21st April. Two 200 kW diesel generating sets. (E.S.B. 7624/59/I.C.A. Ten/38189.)*

25th April. Automatic telephone exchange power plant. (E.S.B. 6736/59/I.C.A. Ten/38080.)*

Malaya.—Central Electricity Board. 26th May. Valves, sluice gates and screens for Cameron Highlands hydro-electric scheme. (E.S.B. 6997/59. Ten/38050.)*

Manchester.—Corporation. 20th April. Street lighting lanterns. (See this issue.)

New Zealand.—Auckland Electric Power Board. 12th June. 6·6 kV switchgear. (E.S.B. 7389/59. Ten/38160.)*

State Electricity Department, Wellington. 30th June. Two 65 MVA transformer banks and spare units. (E.S.B. 7326/59. Ten/38159.)*

G.P.O., Wellington. 15th April. 375 electronic valves. (E.S.B. 7327/59. Ten/38181.)*

Philippines.—National Shipyards and Steel Corporation, Manila. 15th April. Auxiliary machinery, deck machinery and miscellaneous equipment for cargo/passenger vessel. (E.S.B. 6961/59. Ten/38065.)* 28th April. 2,500 kVA outdoor substation. (E.S.B. 7466/59. Ten/38147.)*

National Power Corporation, Manila. 14th April. Control duplex switchboard and accessories. (E.S.B. 7488/59. Ten/38149.)*

Rhodesia and Nyasaland.—Federal Power Board. Air conditioning equipment for Kariba power station. (See this issue.)

Bulawayo Electricity Department. 15th April. Six air circuit-breakers. (E.S.B. 7381/59. Ten/38120.)* 6th May. 88 kV tension and suspension insulator strings, l.v. shackle and pin type insulators, tension and suspension earth wire clamps. (E.S.B. 6701/59. Ten/38064.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 10th April. Switchboards. (E.S.B. 7810/59. Ten/38211.)*. Insulated cable. (E.S.B. 7809/59. Ten/38210.)*

Thailand. — Metropolitan Electricity Authority, Bangkok. 10th April. Eight 15/20 MVA transformers. (E.S.B. 7697/59/I.C.A. Ten/38173.)*

Thai Technical and Economic Committee, Bangkok. 21st April. Radio transmitters/receivers. (E.S.B. 7251/59/I.C.A. Ten/38099.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Barnsley.—Scheme for civic centre; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Billingham-on-Tees.—Infants' school, Low Grange (£47,000); J. W. Henderson & Co., builders, Church Road, Stockton-on-Tees.

Birmingham.—Development of Elmdon Airport; city architect.

Bradford.—New blind welfare centre, Lower Manchester Road clearance area, and health centre at Harrogate Road, Eccleshill; W. Clifford Brown, city architect.

Brandon.—County and modern schools; G. H. Metcalfe, director of education, Shire Hall, Durham.

Bridge-Blean.—Houses (30), St. Vincent's Close, Littlebourne; H. V. Godfrey, architect, 63, Oxford Street, Whitstable.

Brighton.—Abattoir (£23,195); D. J. Howe, borough surveyor, King's Road.

Bristol.—Extensions for James Robertson & Sons, Ltd., Preserve Works; Wm. Cowling & Sons, Ltd., Stratton Street.

Cambridge.—Teaching hospital, Hills Road; Easton & Robertson, architects, 53, Bedford Square, London, W.C.1.

Carlisle.—Civic Centre; Donald Smith, Seymour & Rooley, electrical consultants, 102, Talbot Road, Stretford.

Chester.—Extensions to City High School (£113,253); C. Greenwood, city surveyor, 43, Northgate Street.

Chesterfield.—Houses (90), Dunston Hall estate; borough surveyor.

Coventry.—Airport terminal buildings; city architect.

Croydon.—Covered swimming pool, Whitgift School; Geo. Lowe & Partners, architects, 4, High Street.

Cumberland.—Additional offices, etc., at Millom (£17,500); county architect, Portland Square, Carlisle.

Dagenham.—Works, Freshwater Road; Coborn Engineering Co., Ltd., 45, New North Road, Ilford.

Edinburgh.—Extensions (£180,000); North British Distillery, Ltd., Wheatfield Road.

Felling (Co. Durham).—Modern school, Leam Lane (£174,000); D. Glen, Ltd., builders, Albert Road, Jarrow.

Maisonnettes (59), Wellington Street; J. Clark & Son, builders, Seaham, Co. Durham.

R.C. school, Leam Lane estate; Robert Burke, architect, 10, Lambton Road, Newcastle-on-Tyne.

Gateshead.—Factory additions for Burgess Products, Ltd.; Cackett, Burns Dick & McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Factory additions, Team Valley estate, for Perga Cartons, Ltd.; Monk & Co., contractors, Warrington.

Guildford.—Civic hall and offices; Bridgewater & Shepheard, architects, 42, Bruton Place, London, W.1.

Harlow.—Extensions for Arlington Plastics, Ltd., Industrial estate; Geo. Wimpey & Co., Ltd., builders, 23, Hammersmith Grove, London, W.6.

Hartley Wintney.—Houses (40), Yateley and Odiham; P. J. Mitchell, surveyor, Council Offices, Hartley Wintney, Hants.

Ilford.—Shops, showrooms and offices, High Road; Prudential Assurance Co., Ltd., Holborn Bars, London, E.C.1.

Keighley.—Flats (120), Oakworth Road; Geo. Wimpey & Co., Ltd., builders, 23, Hammersmith Grove, London, W.6.

Kingston-on-Thames.—Five-storey extension to County Hall (£100,000); county architect, County Hall, Kingston-on-Thames.

Lanarkshire.—Remodelling and extensions to Lesmahagow H. G. School and Uddingston Grammar School; I. V. Paterson, county clerk, Lanarkshire House, Ingram Street, Glasgow, C.1.

Largs. — Two underground pumping stations; Carter & Wilson, consulting engineers, 51, Queen Street, Edinburgh, 2.

Leicester.—Office block, Horsefair Street; S. C. Allott & Son, consulting engineers, 1, North Parade, Manchester.

Lexden.—Extensions to primary school; H. & H. M. Lidbetter, architects, 2, Verulam Buildings, Gray's Inn, London, W.C.1.

London.—Multi-storey garage, Upper Thames Street, E.C.; Myton, Ltd., builders, Western House, Western Avenue, W.5.

Extensions for Duple Bodies, Ltd., The Hyde, Hendon; Haymills, Ltd., builders, Hanger Green, W.5.

Reconstruction of West Wing of National Gallery, S.W.; Humphreys, Ltd., builders, Knightsbridge, S.W.7.

Two six-storey blocks and one four-storey block of dwellings, Martineau Street; Howes & Jackman, architects to Council, 1, Verulam Buildings, Gray's Inn, W.C.1.

Newcastle-on-Tyne.—Flats (486); Leslie & Co., Ltd., builders, Darlington.

North Shields.—Factory additions for Torday, Ltd.; Gray & Partners, architects, Camden Street, North Shields.

Perth.—New civic centre, including 16 shops, offices and flats, Neal Vennel redevelopment area (£250,000); burgh surveyor, 16, Tay Street.

Plymouth.—Fourteen-storey administration building and other office buildings, Civic Centre; G. A. Jellicoe & Partners, architects, 5, Princess Square, Plymouth.

St. Asaph.—Primary school; Weightman & Bullen, architects, 76, Rodney Street, Liverpool.

Salop.—Old people's homes at Ludlow and Dawley; C. H. Simmonds, county architect, Column House, London Road, Shrewsbury.

Stamford.—Extensions to Stamford High School; F. J. Lenton & Partners, architects, 16, Broad Street.

Stourport-on-Severn. — Houses (104), Walshes Farm estate; John W. Moffitt, clerk, The Council House.

Wallsend.—Houses (66), Perth Gardens; J. H. James, builder, Archer Street.

Watford.—Factory and offices, Cardiff Road; K. & E. Hurst, Ltd., 94, Rickmansworth Road.

Wednesbury.—Houses (200), Friar Park estate; Drury Construction, Ltd., 17, Coles Lane, Sutton Coldfield.

Werrington.—Primary school; architect, Peterborough Joint Education Board, Bridge Street, Peterborough.

Wigan.—Works extensions; Edmund Taylor (Engineering), Ltd., Skull House Lane, Apperley Bridge.